VOLUME XV MAY, 1915 NUMBER 5

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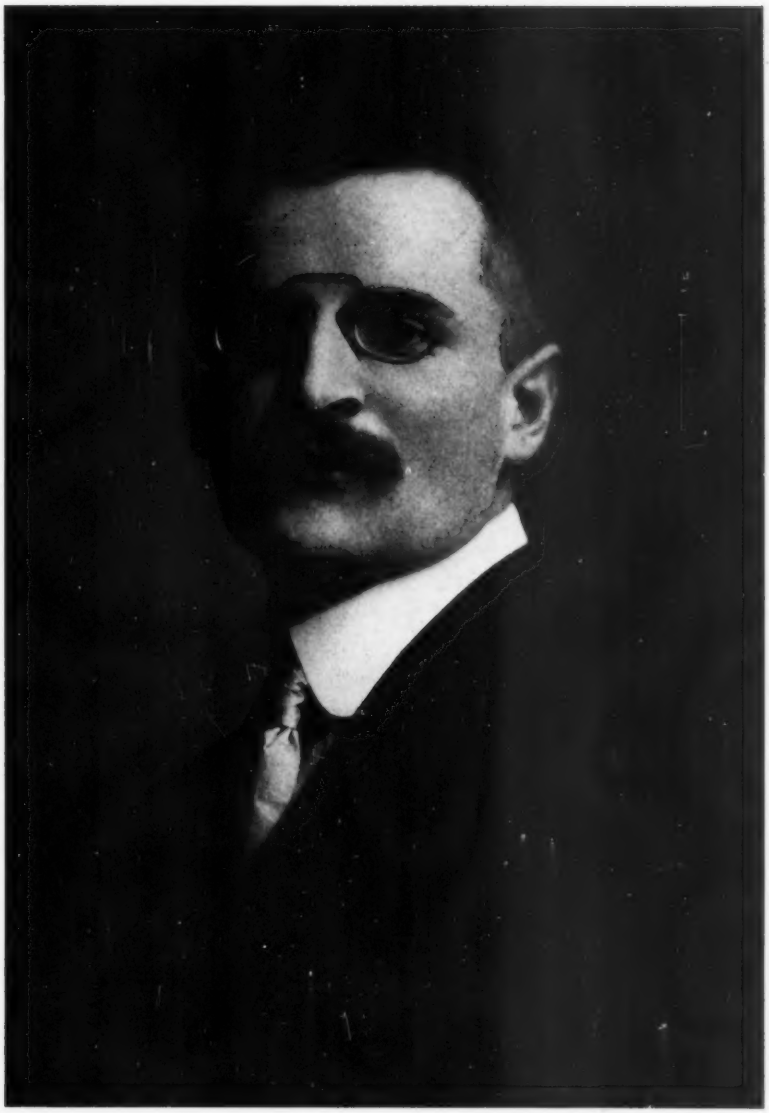
WILLIAM T. HORNADAY

The Director of the Zoölogical Park of the New York Zoölogical Society has no doubt inaugurated and carried to success more movements for the protection of wild animal life than has any other man in America. We owe to him the Wichita and Montana national bison herds, Elk River Game Preserve of British Columbia, and Snow Creek Game Preserve of Montana. He drafted the Bayne Law which since 1912 has prevented the sale of native wild game, as well as the law which since 1913 has prevented all importation of wild birds' plumage for milliners' use. His name is connected also with saving the fur-seal industry. As to his effort to put such protective work on a permanent financial basis for the future, see further mention on page 260



HERBERT LANG

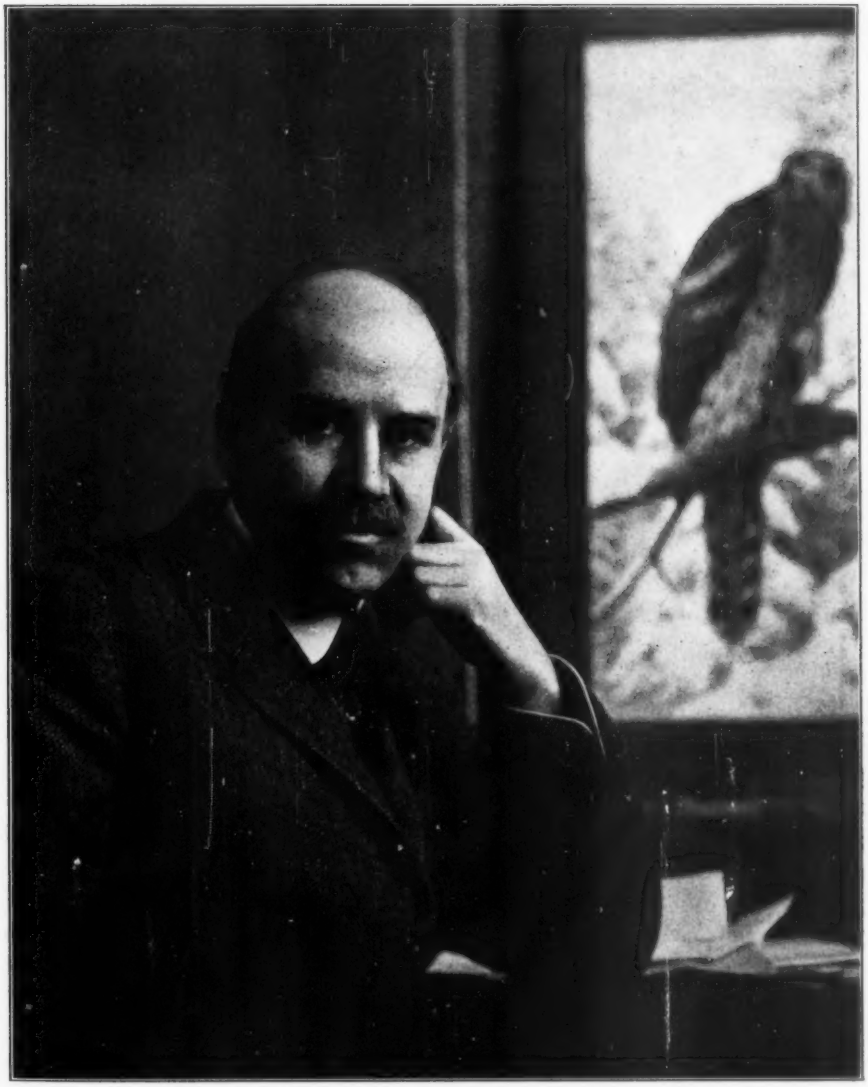
Mr. Lang, as leader for the past six years of the American Museum's expedition to the Belgian Congo, has traveled some three thousand miles under an equatorial sun, and for the most part with heavily loaded caravans, to accomplish the remarkable success achieved in the collection of zoölogical specimens and study of Congo native tribes. Mr. Lang still remains in Africa to attend to the final packing and shipment of specimens

[This photograph of Mr. Lang was made before he sailed for Africa six years ago]

JAMES P. CHAPIN

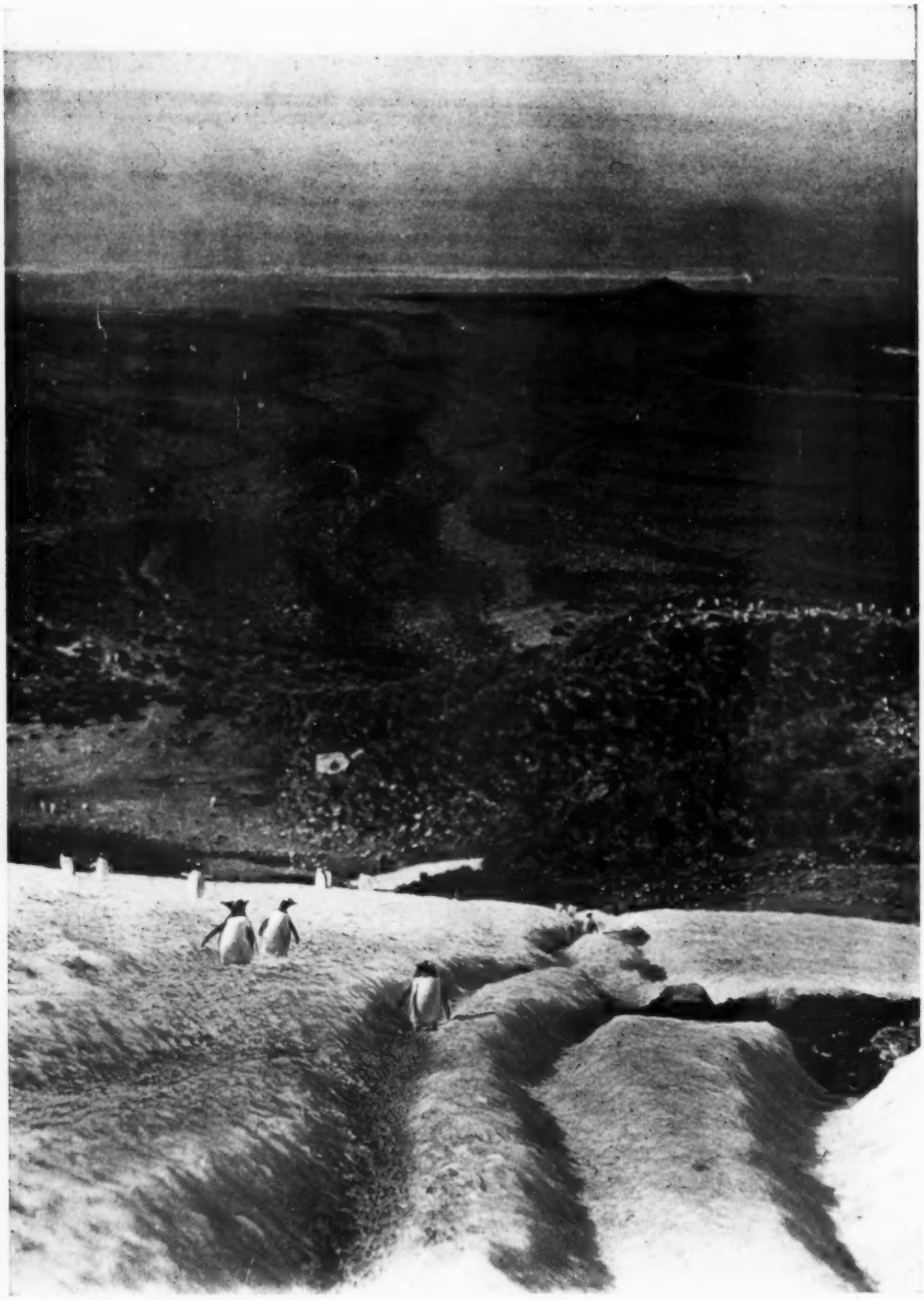
Mr. Chapin has returned to New York after six years of tramping through African jungles as a member of the Congo expedition of the American Museum, during which time he secured the largest and most valuable collection of Congo birds ever brought together

[Mr. Chapin will contribute to the next number of the JOURNAL an article on his experiences in collecting birds in Africa]



LOUIS AGASSIZ FUERTES

A portrait painter of wild birds who bases his work on an intimate sympathetic study of the subject in nature and succeeds in portraying the character of the bird in addition to its external appearance. He is an illustrator of technical and popular books as well as a painter of decorative canvases of considerable size



JOHNNY PENGUINS CLIMBING TO THE ROOKERY

The Johnnies make their homes on the summits of the windy shelterless ridges and trudge gravely back and forth to the sea where they get their food. Broad beaten thoroughfares show the effect of the pattering of little leathery feet through many generations

—" The Penguins of South Georgia," page 225

THE AMERICAN MUSEUM JOURNAL

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OXYGEN AND WATER ON MARS

By Percival Lowell

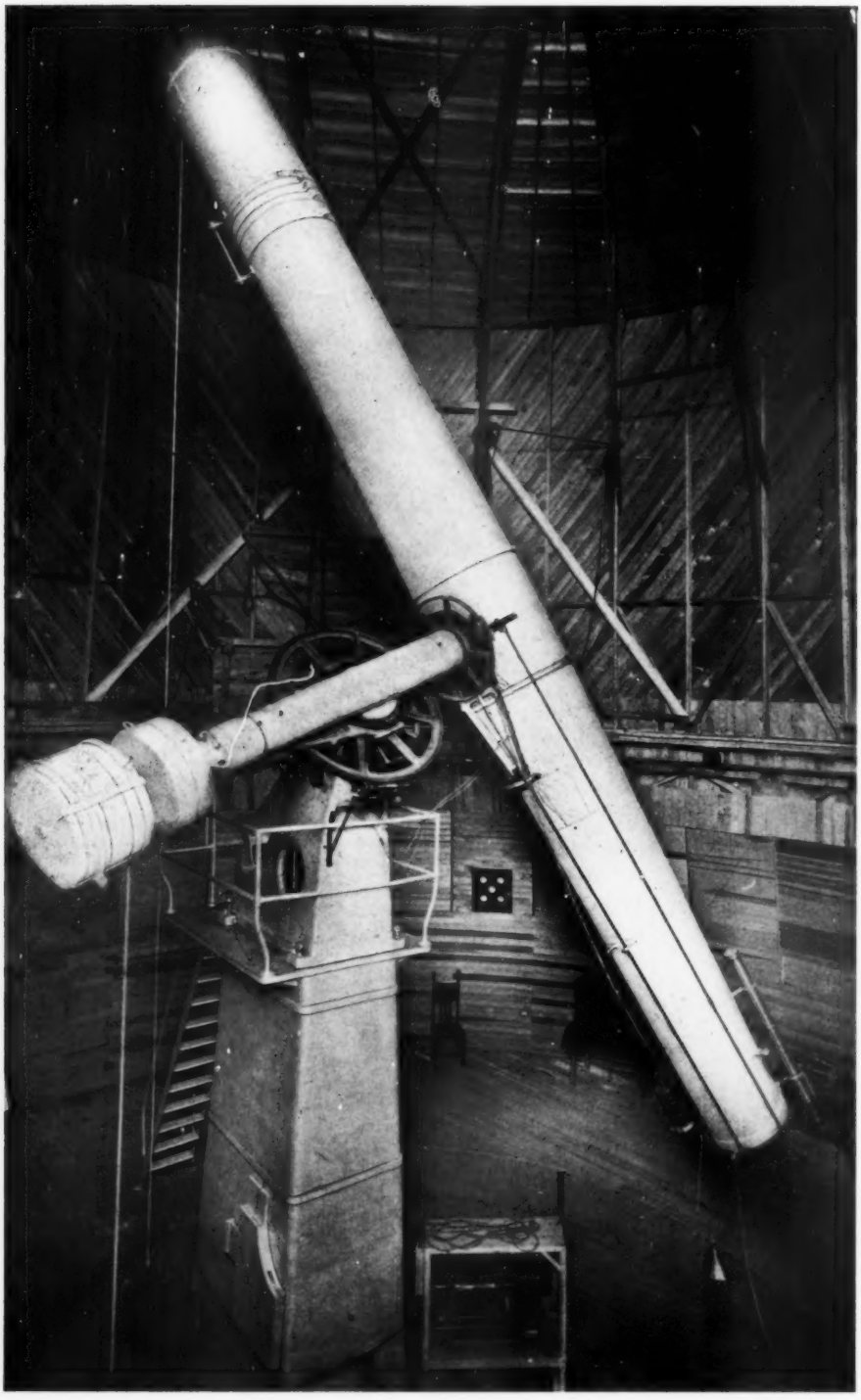
Director of the Lowell Observatory, Flagstaff, Arizona

NEXT to the photographs of the canals of Mars, perhaps the most vitally interesting photograph in the recent work of the Lowell Observatory is a spectrogram of Mars by Dr. V. M. Slipher, disclosing to the average observer merely a darkening of one of the spectral lines (*a*) to the red end of this spectrum over the same line in the collateral spectrum of the moon. But to scientific insight this bit of glass is otherwise transparent. For the slight difference in tone between these identically positioned lines in the two photographs means all the difference between life and death. It reveals the fact that water-vapor is present in the atmosphere of Mars. The moon, an almost absolutely airless body, delivers us the sun's rays unaffectedly and the absorption line in question in its spectrum is caused by water-vapor in our own air. Indeed the spectrum of the moon is simply the spectrum of the sun plus that of the earth, the moon acting only the self-effacing part of a mirror. But in the Martian spectrum the sun's rays have passed in addition through that planet's air and in so doing reveal of what it stands composed. The emphasis it lays upon this line indicates that water, without which all life, vegetal or animal, is impossible, exists upon our neighbor, even as it does here.

Nor is this all that this spectrogram discloses. In the able hands of Professor F. W. Very, measurements of the intensity of another line (*B*) have revealed the presence of oxygen too, in that other world. Here then we have demonstration that both of the chief substances necessary to life are present on Mars.

This evidence was obtained several years ago at a most propitious time, because at the time and place when the earth's air happened to be particularly dry, thus permitting of accentuated contrast. In addition to this however, spectrograms taken by Dr. Slipher more recently, have added to it in an unlooked-for way. Our air, on this latter occasion, was unavoidably more moisture-laden and little was hoped for from the spectrograms beyond a faint corroboration of previous results. When behold, not only did measurement of intensities disclose both water-vapor and oxygen on Mars as before, but these intensities were such as fitted the changed terrestrial conditions, thus adding to qualitative proof, quantitative proof as well. And both fitted in with the Martian meteorology which visual study of that planet has shown us must exist.

Even this is not the limit of the information conveyed by these communicative lines. In Dr. Slipher's latest results, four plates were taken so varied that in two the air above the equatorial regions of Mars was examined, in two



THE GREAT REFRACTINC TELESCOPE, LOWELL OBSERVATORY

This is well known because of the perfection of its great lens and because of the important discoveries made through its use, concerning Mars, Saturn, Jupiter, Uranus and other planets, the stars, comets and nebulæ. Constructed by Alvan Clark and Sons, Cambridgeport, Massachusetts

others the polar atmosphere. The polar snow-cap was then in process of melting and the plates showed that the band in the Martian spectrum, denoting water-vapor, had been intensified seventy per cent in the planet's polar regions and but sixteen per cent in the equatorial over what the band showed in our own. Furthermore, Professor Very remarks about one of the polar plates "there is a brighter streak of continuous spectrum, corresponding to a region of melting snow or of clouds, which gives a larger intensification of *a* (the water-vapor band) than the associated dark streak, when these are measured separately. The diversity of intensification appertains to *a* exclusively — *a* has changed by nearly fifty per cent and this change is certainly Martian." He concludes by saying with regard to oxygen that with the higher altitude of Mars in the later results, the oxygen interposed by the earth's atmosphere being less by one-half an atmosphere, he found the fifteen per cent due to Mars in his earlier measures increased to twenty-four per cent in his later ones, "proving again that this apparent intensification is also real, and is truly Martian, and indicating that the actual amount of oxygen in the Martian atmosphere is about half as great as upon the earth."

Surprising as have been the disclosures due to spectroscopy, perhaps none is greater than that that instrument should inform us of the possibility of life upon another world, a possibility, which, combined with facts that visual observation has revealed (size, mass, temperature and lastly details of the canal-oasis system), amounts, viewed in the light of the doctrine of probabilities, to practical certainty of its existence there.

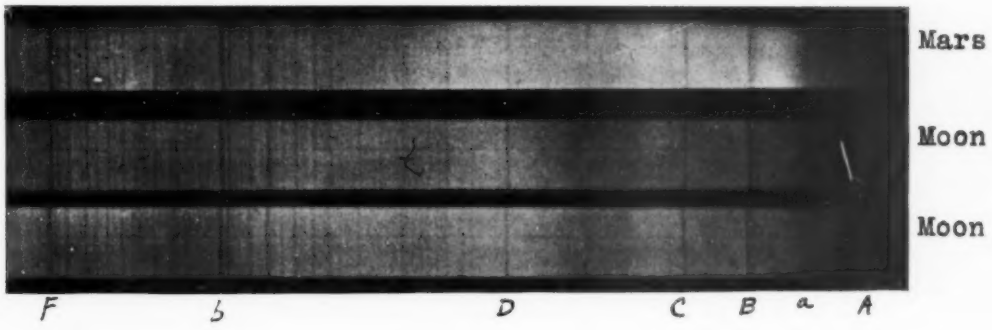


Photo by Dr. V. M. Slipher

Spectra of Mars and the moon. The band marked *a*, well on the right of the spectra, is the band of water-vapor. In the case of the moon the light has traveled only through our own atmosphere, and in that of Mars through the Martian and our own. The difference in darkness shows that water-vapor exists in the atmosphere of Mars. This spectrogram shows also that oxygen exists on Mars, by comparing the line *B*, oxygen, with *C*, hydrogen, in the sun for relative intensities. Its presence was found by very careful measurements by Professor Very with his devised comparator, at the time he evaluated the amount of water-vapor in the Martian air

THE DOME OF THE 24-INCH REFRACTING TELESCOPE

Lowell Observatory, Flagstaff, Arizona, is in longitude 111° 41′.1 W. and latitude, 35° 12′.5 N. It is located at an altitude of 7250 feet, one thousand feet higher than the top of Mt. Washington. This location has helped to make possible many exceptional discoveries

Saturn, photographed by Dr. Lowell, March 12, 1915, showing the ring open to its widest extent

THE PHOTOGRAPH IN ASTRONOMY

By E. C. Slipher[1]

Lowell Observatory, Flagstaff, Arizona

DURING the last two decades the application of photography to researches in astronomy and in other sciences as well, has been fraught with numerous important advances. Through its use in astronomy we have learned many new facts which have confirmed or refuted the old theories and created new scientific belief; and furthermore photography furnishes permanent pictorial record of the evidence, accurate and incontestable, that all may see and believe. No argument carries a conviction equal to that gained by seeing the thing oneself.

Excellent photographs of the great planet Jupiter have been made through the 24-inch refracting telescope of the Lowell Observatory, Flagstaff, Arizona. They show at a glance the conspicuous belted appearance of the visible surface—probably the zoned formation of the various gases of a very dense atmosphere beneath which we seldom if ever see — and innumerable, finer, wisplike markings interlacing the belts. Photographs of the planet showing different longitudes present a varied aspect of these belts, and the photographs taken in different years indicate many evident chaotic changes there.

Across the ball of the planet Saturn there will be noted in the photographs quite similar although less pronounced beltlike markings paralleling the equator; this indicates a like condition of the atmospheres of Jupiter and Saturn. The unique rings about Saturn are remarkably well shown in photographs, with Cassini's division distinctly visible all the way around, separating the two brighter rings. The third and inner ring — the filmy crêpe ring — is too faint to show except where it crosses the ball, without an overexposure, although much of the original definition is lost in the enlarged reproductions due to the separation of the silver grains of the emulsion. It will be seen that the ball of Saturn shines through the outer ring where it crosses the planet on the lower side; this tells how very thin the rings are and evinces their meteoric constitution. The definition of these planetary

[1] Mr. E. C. Slipher has been directly associated with Dr. Lowell in his work on Mars at the Flagstaff Observatory for many years. He has gone also on various expeditions, among them one to Alianza, Chile, in 1907, to observe Mars.

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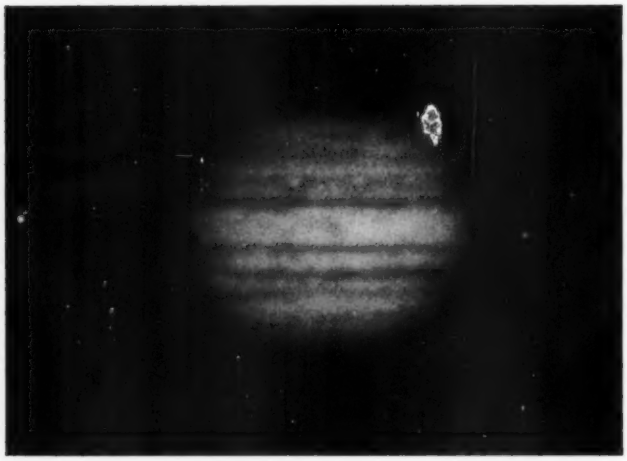
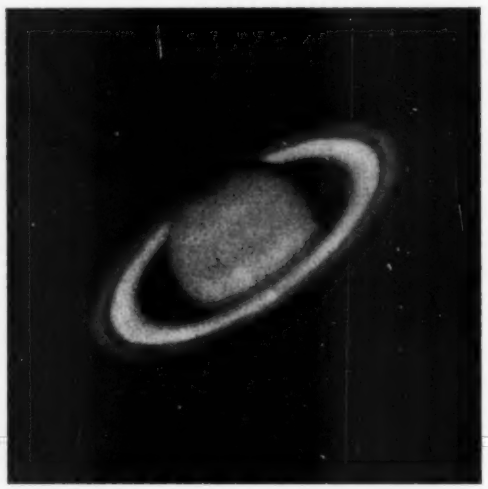


Jupiter, September 23, 1914. To the left of the planet is seen a small round bright spot against the sky. This is Satellite III. It has just crossed the face of the planet. On the extreme right of this face (the left of the photograph) is its shadow just entering on the disk. It denotes an eclipse of the sun taking place for Jupiter at that point. Some distance to the right of the planet is shown another round bright spot. This is Satellite I, soon to transit the disk and cause another solar eclipse. This plate, securing both planet and satellites on such a scale and definition, is, as far as known, unique

photographs where exposures of as much as thirty seconds were required, attest to the exceptional atmospheric conditions existing at Flagstaff.

Although less picturesque than the direct photographs, the spectrographic observations are just as replete with revelations. After the light from a celestial object has passed through the prism of a spectrograph, many important facts are disclosed concerning it which would be impossible to learn by other means. It is from spectrum analysis that we obtain much of our knowledge of the density and constitution of planetary atmospheres; of the motions, constituents and the states of stars, comets and nebulæ. The spectrogram of the Saturnian system shows the lines in the ball spectrum and those of the rings to be oppositely inclined showing that the rate of revolution differs for each part of the rings, thus presenting a direct demonstration of the fact first found mathematically, that the ring system is composed of disjoined particles. In the spectrum of the planet Venus the absence of inclination of the lines shows its diurnal rotation to be exceedingly slow, which confirms the early observations of Schiaparelli and Dr. Lowell who found its day and year to be equal. This causes Venus to present always the same face to the sun. The day of Uranus was unknown, due to the absence of any marked surface



Saturn, December 23, 1912. It is as seen in a telescope magnifying about 1400 times, thus covering an area approximately 200 times that of the moon to the naked eye. Cassini's division is the dark gap separating the two bright rings. The inner or crêpe-ring is visible where seen against the ball of the planet. Saturn's belts are a counterpart of Jupiter's; both planets are in a "youthful chaotic state, swathed in cloud"

detail from which it could be deduced, until photographs of its spectrum made at Flagstaff in 1910 and 1911 revealed for it a retrograde rotation which it accomplishes in a day of about ten and three-fourths hours.

It is from a similar analysis of their light that the motions of stars and nebulæ are found. The incandescent condition of these bodies makes it possible to ascertain the identity of the substances of which they consist; and by a comparison of their spectra with that of our sun, some knowledge is obtained of their state of evolution. Many startling discoveries result from these investigations, especially in case of some of the nebulæ whose velocities of approach or recession are so great as almost to defy belief, reaching in several instances, one thousand kilometers per second.

In one case at least, that of the nebula in Virgo, Dr. V. M. Slipher has detected the rotation of this great mass by the inclined lines of its spectrum. Another interesting and unique spectrographic discovery is that the wisplike nebula in the Pleiades in all probability shines by reflected light received from relatively near by stars. This is the only known example of a nebula that shines by any but its own light.

Direct photographs of the great Halley's Comet and Comet *a* 1910 show remarkable structural details and the great length of their tails which stretch from thirty to fifty degrees or more across the sky. The cloudlike streamers in the tails of these comets indicate something of the rapid flow away from the head of the mingled meteoric and gaseous material, and

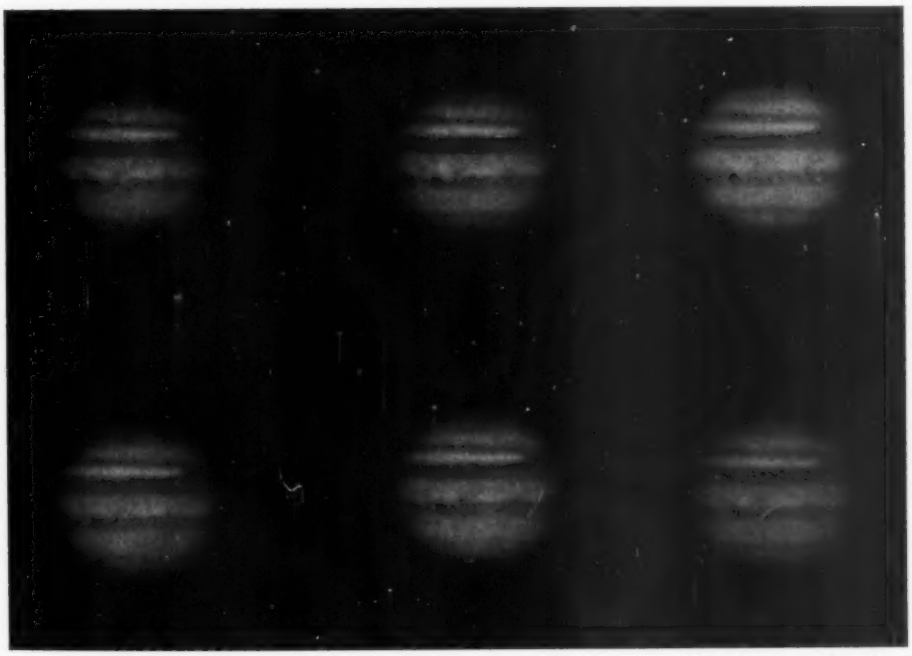
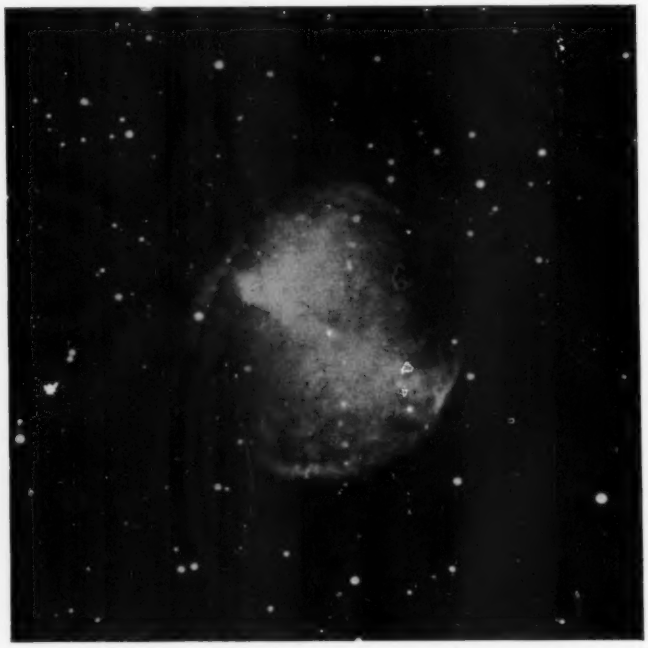


Photo by C. O. Lampland

Jupiter, August 11, 1913. In order to secure the best images of a planet photographically, it is advisable, since our air is never at its best for long, to make many exposures consecutively, moving the plate first laterally and then up and down. We thus get a chance at a good photograph and furthermore one photograph corroborates another

particularly in case of Comet *a* 1910 the curved, fanlike form of the matter in the tail gives evidence of solar forces repelling them.

The dark-line nebula in the constellation Virgo. Photographed with the 40-inch reflector, April 18, 1911. An object of unusual interest on account of its rapid motion — 600 miles per second in the line of sight — and also because it is the first nebula for which rotation about an axis and proper-motion have been observed



The "dumb-bell" nebula in the constellation Vulpecula. Photographed with the 40-inch reflector of the Lowell Observatory

Both slit and slitless prismatic photographs of Halley's, Gale's, Brook's and other comets of recent years, segregate and make known the various constituents. In this analysis the prism differentiates the constitution of the head and tail, and even the substances composing different streamers in the tail can be identified. In general, comet spectra are quite similar; they show the existence, usually, of cyanogen, sodium and hydrocarbons in the head while carbon monoxide and solid sunlit particles produce mainly comet tails.

The spectrograph serves also as a barometer which enables one to read many of the existing conditions of planetary atmospheres. It tells us that Jupiter, Saturn, Uranus and Neptune are surrounded by very dense atmospheres and that the densities of these increase with the distances of the planets from the sun. It was by this means that evidence has been secured at the Lowell

Photo by C. O. Lampland

COMET *a* 1910

One of a series of direct photographs taken at Lowell Observatory

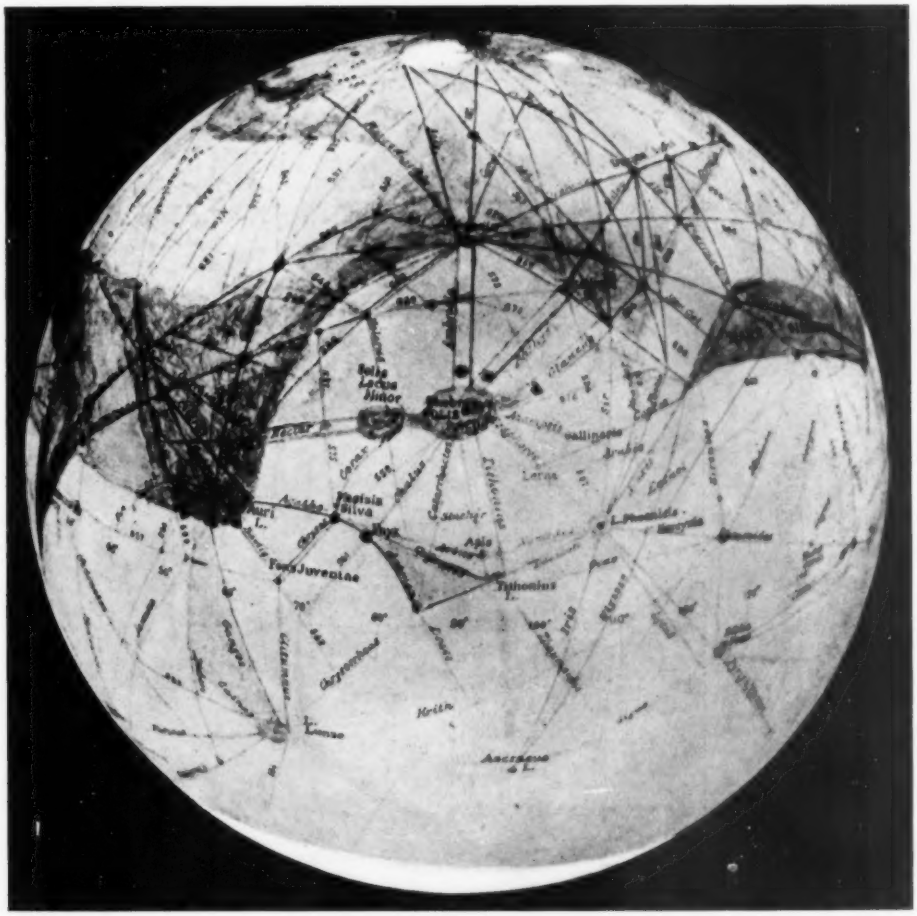
From drawing by Percival Lowell

Globe of Mars, longitude 270°, 1909. Dr. Lowell has discovered that the canals of Mars wax and wane, have what appears to be a "live" and a "dead" season. They are thought to be strips and oases of vegetation sustained by the waters of melting solar snow-caps, distributed through canals constructed by intelligent beings

Observatory, that not only does Mars have an atmosphere, although less dense than the earth's, but that it contains the essential life-supporting substances, oxygen and water-vapor.

Photographs by Mr. C. O. Lampland taken with the great reflecting telescope of forty inches aperture, at the Lowell Observatory, show star clusters containing almost countless suns similar to our own, but so distant that their light travels hundreds of years to reach us; as well as examples of the different classes of nebulæ presenting unique and interesting forms. Also, photographs of our moon show clearly the great craters many times larger than any on the earth, and mountains which rise to a height of ten thousand feet or more.

What has created most interest, however, are the non-pareil photographs of the Martian canals — the possible ingenious handiwork of intelligent beings. These peculiar markings characteristic of Mars only, were first detected in 1877, by the eminent Italian astronomer, Schiaparelli. Because of similarity of



From drawing by Percival Lowell

Mars, longitude 90°, 1909. These drawings agree with the photographs taken of the planet although made independently without any knowledge of what the photographs would show, some of the latter having been taken indeed at a station in Chile seven thousand miles away

color and of their connection with the large dark green regions, which were then generally supposed to be lakes and seas, Schiaparelli was led to believe them to be rivers or channels dividing the continents, and thus they received from him the name *canale*. In 1892 the same linear markings were found to invade also the "seas" of Mars, and it was found too that the positions of these canals remained permanent. This disproved the existence of the supposed seas. Then it was soon discovered by Dr. Lowell that the canals waxed and waned, that they had a "live" and "dead" season and thus he announced, in 1894, the theory that the canals and lakes of Mars were not water but strips and oases of vegetation sustained by the waters of the melting polar snow-caps, and distributed over the arid planet by an artificial canal system constructed by intelligent beings.

As time passes and our knowledge of Mars increases, this theory becomes more and more probable. It satisfies all the facts brought out by observation and accounts for the remarkable changes

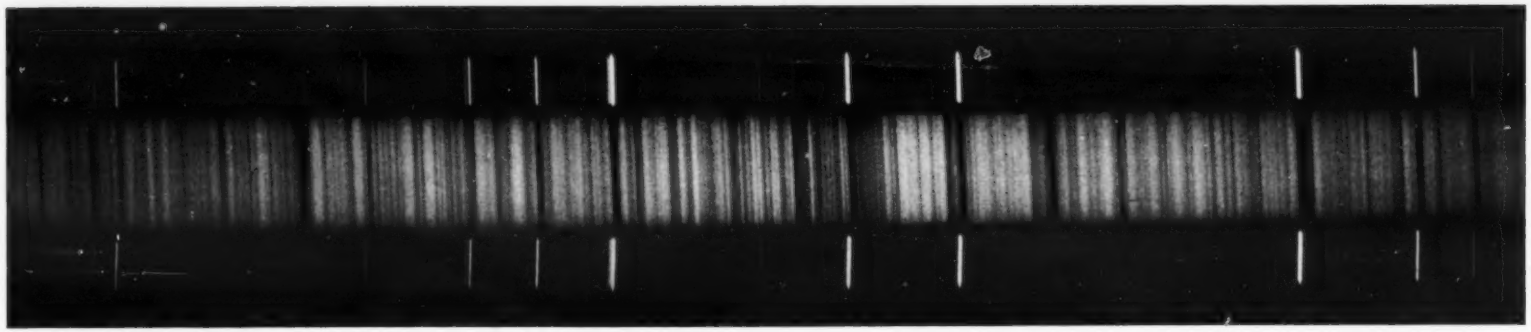


Photo by V. M. Slipher

SPECTROGRAM OF JUPITER

Light from a celestial body passing through the prism of a spectrograph gives revelations learned in no other way. These concern the constitution of the atmospheres of planets, and the motions and constituents of stars, nebulæ and comets.

From the spectrogram of Jupiter, we learn that this planet has a very dense atmosphere. The bright lines at the upper and lower edges of the Jupiter spectrum are of the comparison spectrum. The dark lines in the Jupiter spectrum lean to the left at the top edge, in consequence of the rapid rotation of Jupiter. By measuring this slant of the lines the length of Jupiter's day can be accurately determined

occurring in the peculiar network of markings which geometrically thread the planet's surface. Critical and serial observations embracing years of study of the planet by the keen eye of Dr. Lowell have revealed a close connection between the melting of the polar snows and the intensification of the canal system. This development of the marks of vegetation follows the passing of the sun from one hemisphere of the planet over the other and is most intense during the Martian spring and summer seasons. Mars is in a more advanced stage of planetary evolution than the earth and it has but a meager supply remaining of either air or water. Dr. Lowell believes that the numerous linelike markings seen there are those of vegetation growing by an enforcedly constructed irrigation system. Two significant facts found by observation support his theory: first, the marked geometric directness of the lines — no natural causes can account for them; second, the characteristic manner in which they develop with the seasons and the melting of the snow-caps.

That the canals and oases do change markedly in intensity from time to time, is evidenced, directly and indirectly, by the observations of a number of astronomers. The photographs of the planet also prove this. As far back as 1877 Schiaparelli observed their disappearance and subsequent reappearance which he attributed to the presence of Martian clouds but it is now known that clouds never occur on Mars sufficient to obscure such surface details. In fact clouds are very rarely indeed observed there and when they do appear, they are seen only as dust storms along the planet's terminator. It is clear therefore that the changes he saw in the intensity of the canals were not apparent and due to clouds as he thought, but real and due to seasonal variations in the vegetation.

Ever since Schiaparelli discovered the canals a spirit of skepticism, although not general, has existed regarding their reality and the observations of those who have seen them have met with considerable criticism. Various theories have been advanced to explain them as illusions, but these theories suffered sure and sudden destruction when in 1905 Mr. Lampland with camera and methods of his own design first succeeded in photographing them. Subsequent improvements of the method brought better results and during the succeeding oppositions of the planet a majority of the canals and oases have left their imprint on the photographic plate. However it is to be remembered that seeing with the eye is almost instantaneous, while with the photographic emulsion frequently a time exposure is required. Because of this, and the fact that even in the most tranquil air the telescopic image remains quiet but for a very short period of time, the photographic image stands at a great disadvantage, being a poor average picture of the planet at that moment.

The importance of these Martian discoveries has been indicated and emphasized by the denunciation they have called forth. It is the old story over again of the reception of an advanced idea, the same intellectual inquisition which scouted the discovery by Roemer of the velocity of light, and refused publication to Mayer's and then Helmholtz's detection of the law of the conservation of energy. Every new idea in science, Huxley said, starts as a myth to end as a superstition. The very same cast of mind that rejected the conservation of energy for publication in the best physical magazine of Berlin because of its supposed absurdity, when it was young, is proclaiming it, now that it is old, the greatest scientific advance of the nineteenth century.

Courtesy of D. Appleton and Company

SOME OWL PORTRAITS

Fuertes' bird portraits, like those of a great painter of men, depict character and individuality

LOUIS AGASSIZ FUERTES—PAINTER OF BIRD PORTRAITS

By Frank M. Chapman

LOVE of birds as "the most eloquent expression of nature's beauty, joy and freedom" is the rightful heritage of everyone who in one way or another hears the call of the outdoor world. But that inexplicable fascination for birds which awakens an instinctive uncontrollable response to the sight of their forms or the sound of their voices, which arouses a passionate desire to become familiar with them in their haunts and obtain an intimate insight into their ways, and which overcomes every obstacle until, at least in a measure, this desire is gratified, is the gift of the gods which marks the true ornithologist. In him the universal, if not always developed, love of birds is supplemented by the naturalist's longing to discover the secrets of nature. Your true bird student, therefore, is a curious, and sometimes contradictory combination of poet and scientist.

Men in whom this taste and ambition combine to make birds the most significant forms of the animal world, are not numerous; but a great painter of birds must be primarily a man of this type. When therefore one considers how small is the chance that the essential attributes which make on the one hand an ornithologist, on the other an artist, will be found in one individual, it is small wonder that the world has known so few real bird portrait painters.

Artists who introduce into their canvases birds as impossibly feathered as conventional angels, artists who paint birds with more or less accuracy of color and form and, more rarely, pose, have not been few in number; but the artists who paint bird portraits based on an intimate, sympathetic, loving study of their subject in nature, and who have the ability to express what they see and feel, can be counted on one's fingers, and the name of Louis Agassiz Fuertes would be included before the second hand was reached.

Fuertes in possession of a freshly captured specimen of some bird which was before unknown to him is, for the time, wholly beyond the reach of all sensations other than those occasioned by the specimen before him. His concentration annihilates his surroundings. Color, pattern, form, contour, minute details of structure, all are absorbed and assimilated so completely that they become part of himself, and they can be reproduced at any future time with amazing accuracy. Less consciously, but no less thoroughly and effectively, does he store impressions of the bird's appearance in life, its pose, mannerisms, characteristic gestures of wings, tail or crest, its facial expression — all are recorded with surprising fidelity.

This indeed is the keynote of Fuertes' genius — for genius it is. His mind appears to be a delicately sensitized plate designed especially to catch and fix images of bird life; and of such images he has filed, and has at his finger tips for use, a countless number; for his opportunities for field study have been greater than those of any other painter of birds. It has been my good fortune to be with Fuertes on many occasions when for the first time we met with some particularly interesting bird in nature. At such times there was perhaps no very marked difference in the extent of our enthusiasm or the manner in which it was expressed;

but all the time, subconsciously, Fuertes' mental photographic processes were making record after record. At the moment not a line would be drawn or a note written, but so indelibly and distinctly was what he had seen, etched on his memory that it could later be visualized as clearly and faithfully as though the original were before him.

Fuertes' bird portraits, like those of a great portrait painter of men, depict not only those externals which can be seen by any observant person, but they reveal character. Examine, for instance, the drawings of owls' faces, or the sketches of toucans which are reproduced in this connection, and note how much individuality is expressed in each drawing. These pictures are instinct with life and differ from the work of the inexperienced or unsympathetic artist as a living bird differs from a stuffed one.

Fuertes was born at Ithaca, where he now lives, in 1874. In 1897 he was graduated from Cornell, of which his father was director of the College of Civil Engineering. Drawing birds was with him as natural an outward evidence of an inward condition, as with most children spinning tops is an expression of an inherent love of play. Before his graduation he had made the illustrations for Florence Merriam Bailey's *Birding on a Bronco*, and Mabel Osgood Wright's and Elliot Coues' *Citizen Bird*.

It was the encouragement he received from Coues that led him definitely to decide to become a painter of birds, and the immediate recognition his work received permitted him to give rein to the naturalist's longing to see the birds of other lands.

In 1898 therefore he went with Abbott H. Thayer, under whom he was studying, Gerald Thayer and Charles R. Knight, to Florida. The following year, as a member of the Harriman Expedition to Bering Sea, he had exceptional opportunities to meet in life many boreal birds which had been studied by few, if any, bird artists. The reports of this expedition contain some of the studies made on this trip. In 1901 he accompanied a party of the Biological Survey into western Texas. In 1903 he studied in California and Nevada; in 1904 in Jamaica; and in 1909 in the Gulf of St. Lawrence.

In 1902, 1907, 1908–11 and 1913, Fuertes acted as artist to the American Museum's expeditions, which during these years made field studies and gathered material for habitat groups in the Museum from the Bahamas, Florida, Saskatchewan and Alberta, Yucatan, Mexico and Colombia.

On these expeditions he has collected about thirty-five hundred specimens which are beautifully prepared and fully labeled with data of special value to the artist, when necessary. These data are in the shape of color sketches of bill, feet, eyes, or other unfeathered areas, the colors of which disappear after death. Such studies can be obtained only from the living or freshly captured bird, and Fuertes' collection of them is unique.

As the artist of Museum expeditions, Fuertes has not only made sketches of the birds secured, but oil studies of the landscape selected as the panoramic background for the habitat group in which the birds were later to appear. In each instance these are accompanied by detailed color sketches of leaves and blossoms for the guidance of the preparator of the vegetation modeled for the group. Where birds appear in the background of the completed group, they are painted there by Fuertes himself; and the landscapist who realizes his limitations gladly avails himself of this expert coöperation. Thus we have in these groups (notably the flamingo

STUDIES OF SOUTH AMERICAN TOUCANS

Fuertes' opportunities for field study have been greater than those of any other painter of birds. For just his work on the bird groups in the American Museum he has studied in the Bahamas, Florida, Saskatchewan and Alberta, Yucatan, Mexico and Colombia

group), paintings by this artist which to bird lovers of later generations will have all the interest a panoramic painting by Audubon of, for example, a flight of wild pigeons would have for us to-day.

Because of the accuracy of his work, Fuertes is ever in demand as the illustrator of technical and popular books and articles on ornithology. His contributions to publications of this nature amount to thousands of drawings; many of them have been adequately produced in color and through their wide circulation, they have exercised an educational influence of the highest importance. Such for example are the illustrations in Eaton's great work on the *Birds of New York*, published by the State; those in the *National Geographic Magazine*, and the series appearing in *Bird-Lore*.

In all of these illustrations everything is made subservient to the bird itself, which usually claims as large a share of the picture as it does of Fuertes' attention. But in a series of twenty-four large panels in oils, done for the library of Mr. Frederick F. Brewster of New Haven, the birds, chiefly water-fowl and shore birds, take their proper place in a series of strongly handled landscapes which reveal Fuertes' art in a new aspect. With no sacrifice of his skill and insight as a painter of bird portraits, he has here placed his subjects in a setting which adds immeasurably to their beauty and to the appeal they make to the imagination. These pictures, in the writer's opinion, are Fuertes' greatest achievement and point the way for the development of his exceptional gifts.

Property of F. F. Brewster

Peregrine falcon with bufflehead. From painting by Fuertes.

Property of the Artist

BARRED OWL

The "hoot owl" is still a fairly common bird in all of the wooded parts of eastern North America. Like most birds of prey, it is misunderstood and is persecuted on sight, although its food consists almost exclusively of small destructive mammals, birds forming no regular part of its fare

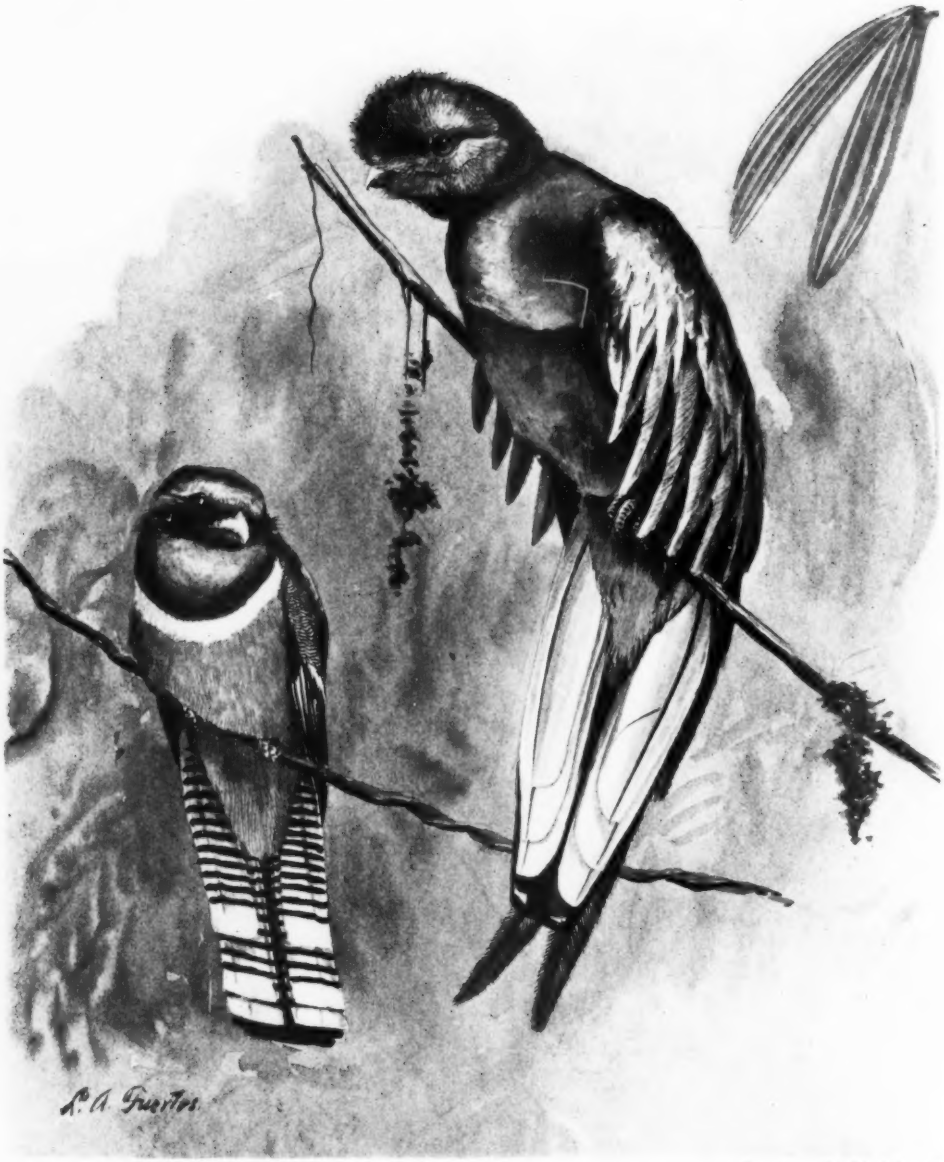
Property of Truman E. Fassett

GOLDEN EAGLE AND PTARMIGAN IN THE ROCKY MOUNTAINS

Property of F. F. Brewster

WILD TURKEY

Formerly inhabiting the entire forested parts of North America from Hudson Bay to the Gulf of Mexico and west to the Great Basin, the turkey is now extinct north of Pennsylvania and common only in a few greatly restricted regions. It is America's finest contribution to domesticated poultry



Courtesy of "Bird-Lore"

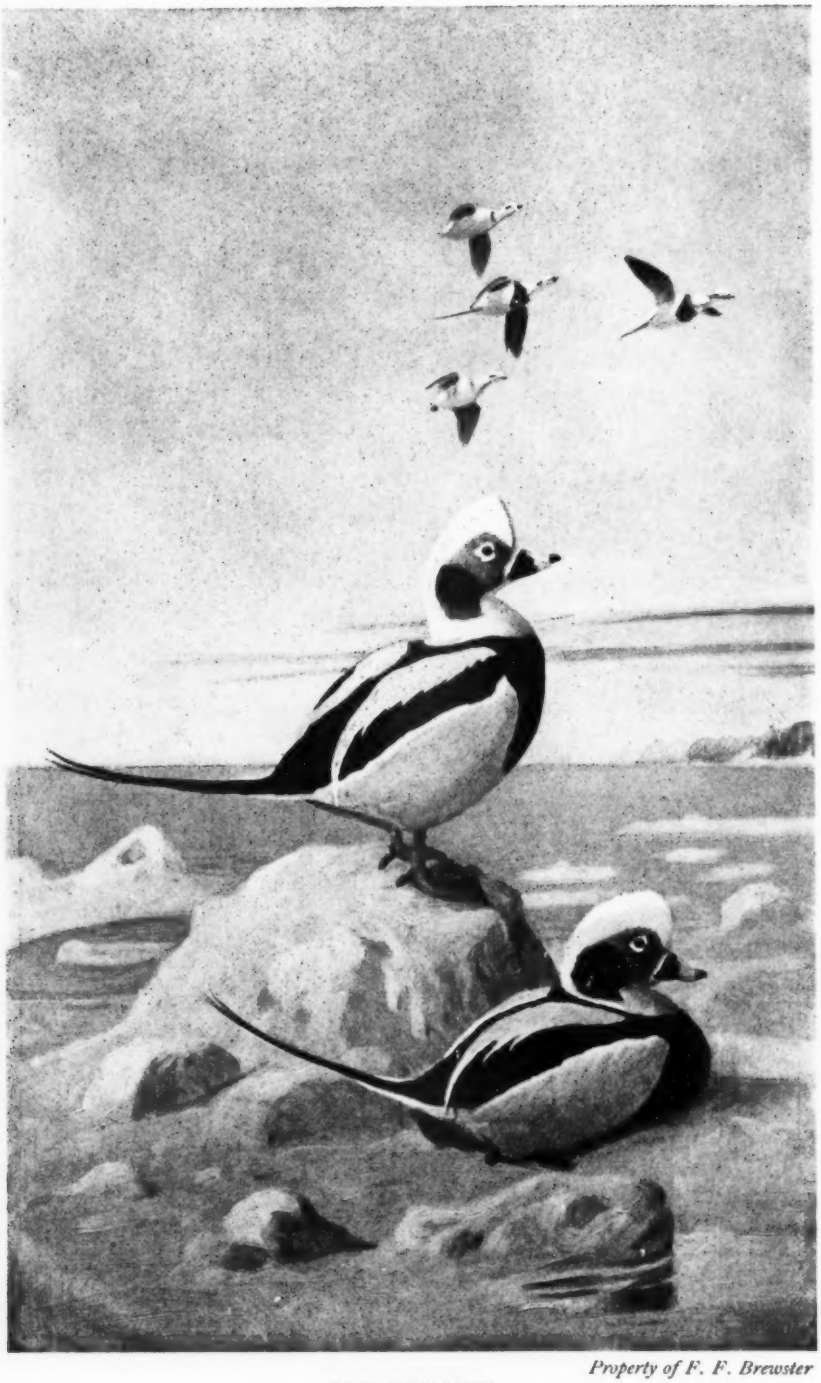
TROGONS FROM COLOMBIA

The trogons are tropical birds of superlative beauty, being of the richest iridescent greens, violets and blues above, with underparts of blood red or purest yellow. The most gorgeous of all, the sacred Quetzal of the Aztecs, is related to the larger bird figured

Property of F. F. Brewster

CANVASBACKS

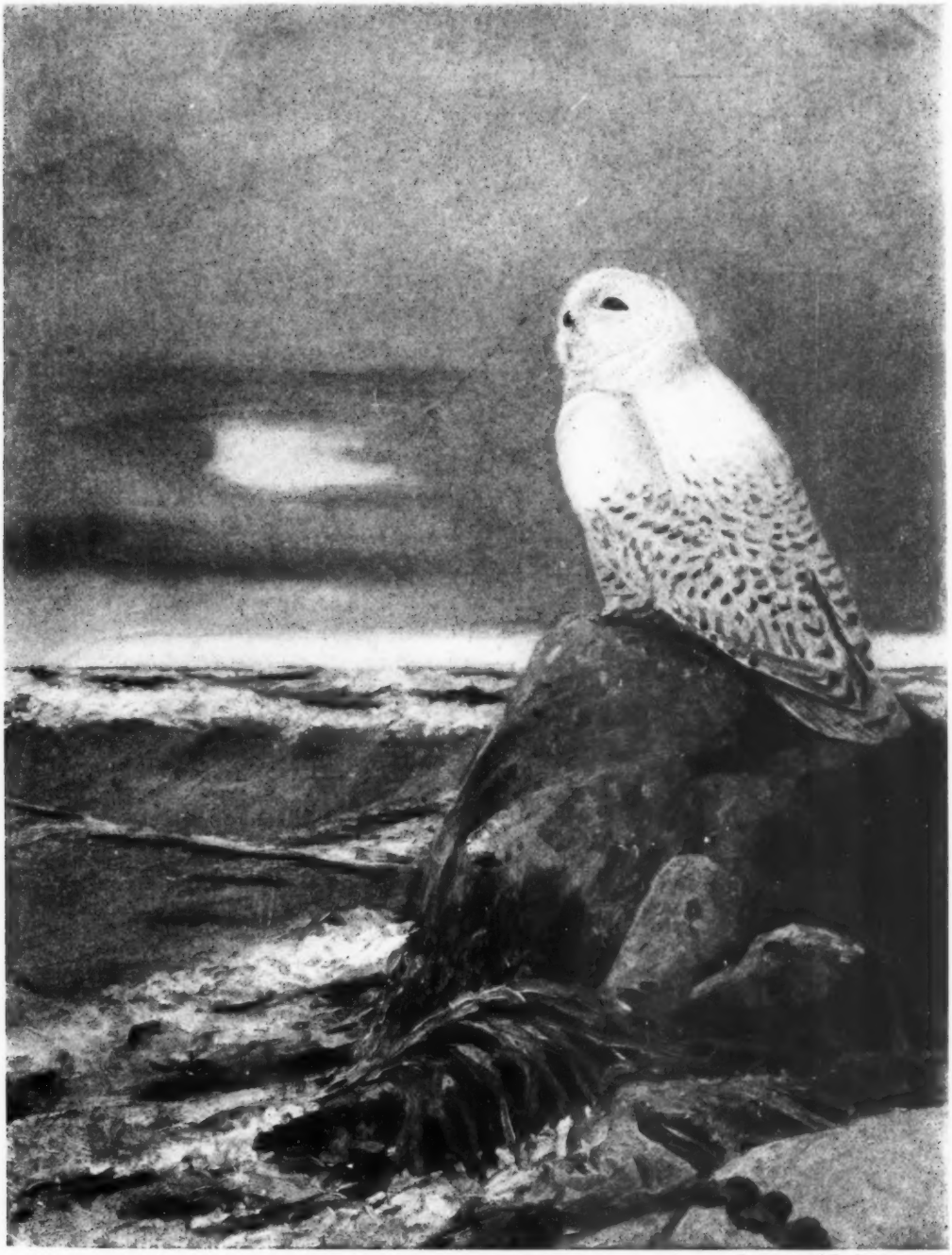
This painting shows a group of canvasback ducks wintering on Cayuga Lake. It is one of a series of twenty-four decorative panels in oil owned by Mr. Frederick F. Brewster of New Haven



Property of F. F. Brewster

OLD SQUAWS

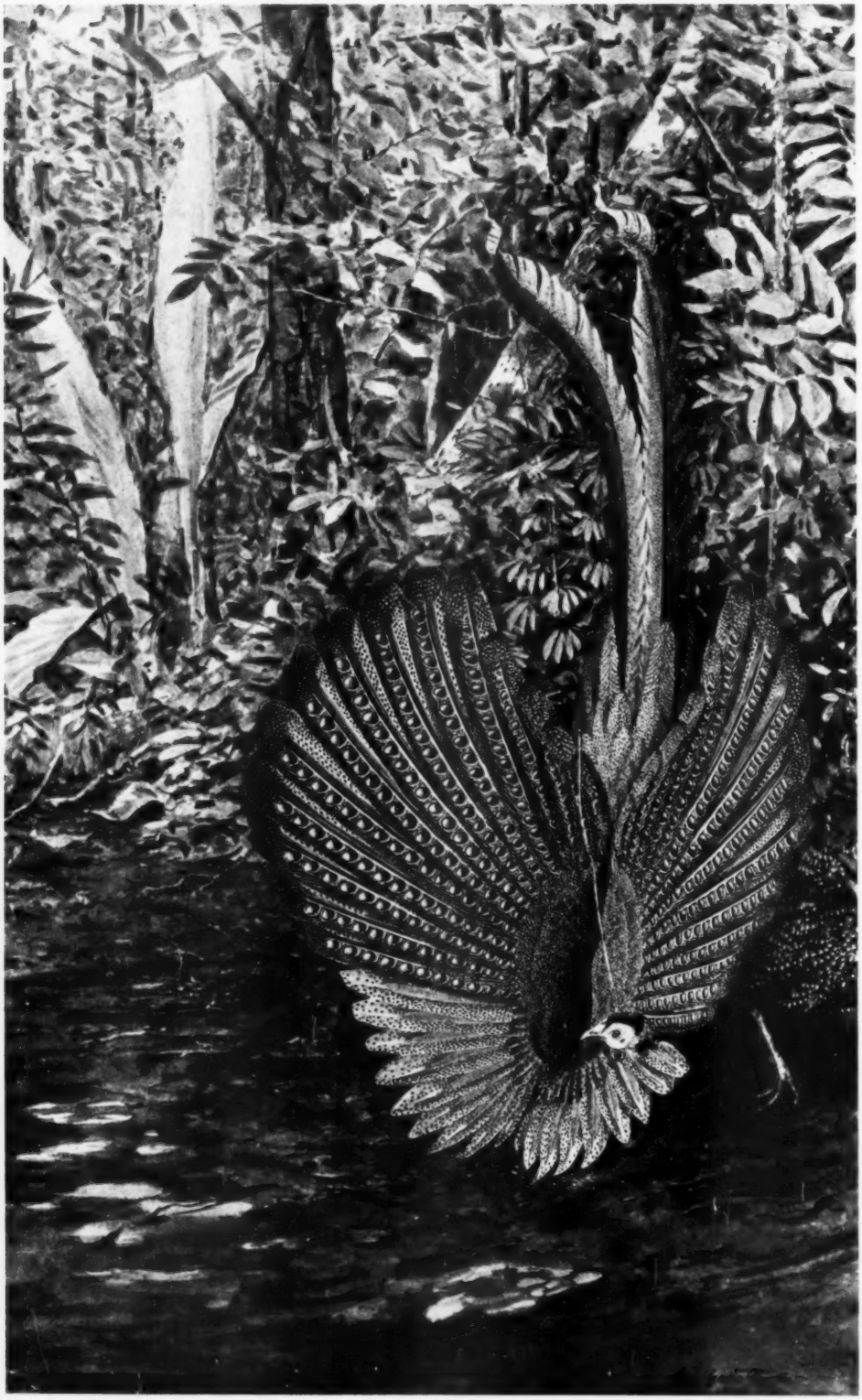
Old squaws breed closer to the pole than any other bird except the knot sandpiper. They are wonderful divers and are frequently caught in the Great Lakes in whitefish nets set in fifty fathoms



Property of F. F. Brewster

SNOWY OWL

Nesting mainly within the Arctic circle, this owl comes well within the United States in winter, being always more abundant along the sea-coast. Its food is largely fish, caught from the edge of the ice or gleaned from the beaches at low tide



Owned by the Artist

ARGUS PHEASANT, DISPLAYING

Little is known of the habits of the argus pheasant of Malay Peninsula, Java and Borneo, as it is nocturnal and dwells in humid forests

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Deserted by his fellows, this young Johnny has his "heart in his throat"

THE PENGUINS OF SOUTH GEORGIA

"JOHNNIES" AND "KINGS" ON A DESOLATE SUBANTARCTIC ISLAND[1]

By Robert Cushman Murphy

Illustrations from photographs by the Author

THE territory of the "Little People of the Antarctic" has lately been subjected to so many friendly invasions that we are beginning to feel fairly well acquainted with a number of their tribes. First in entertaining word pictures, then in photographs, and finally in the beauty and realism of the cinematograph film, we have been shown something of the life histories of the jolly little Adélie penguin, the stately emperor and several others.

Owing to the recent interest in exploration and discovery upon the south polar continent itself, the penguins[2] inhabiting those uttermost shores have been studied somewhat to the exclusion of species equally interesting, and longer known to man, which dwell outside the Antarctic Circle and make their homes upon the chain of desolate Subantarctic islands. During the American Museum's recent expedition to South Georgia, which lies within the ice-fields of the South Atlantic, two species of penguins were intimately encountered —

[1] Article and photographs copyrighted, February, 1915, by Robert Cushman Murphy.

[2] A study of the habits of penguins is particularly valuable at this time when public interest has recently been given to Sir Douglas Mawson's wonderful moving pictures of penguins, taken on the Australasian Antarctic Expedition and exhibited daily at Weber's Theatre in New York City during one of the spring months.

It is to be noted that none of the species pictured by Sir Douglas Mawson (the Adélie, emperor, gentoo, Victoria, king and royal) nor those described by Mr. Murphy have ever been kept in zoölogical gardens, although a few unsuccessful attempts have been made with the king penguin in Europe. One can study in the New York Zoölogical Park at the present time several specimens of the blackfooted penguin (*Spheniscus demersus*) from South Africa [purchased through German dealers].— THE EDITOR.

the magnificent king penguin (*Aptenodytes patachonica*) and the companionable little Johnny penguin (*Pygoscelis papua*). The former are dignified, imposing birds, standing a yard high, contented with their own society, and indifferent toward other creatures. As a badge of aristocracy they wear around their necks gleaming gold collars. The Johnny penguins, on the other hand, are roly-poly and plebeian, interested in everybody, and quite remind one of small boys. The two species live on the same territory and follow the same vocation of deep-sea fishers, yet their society is inviolably distinct.

We first met the Johnny penguins on the southward voyage in latitude 43° S., on November 15, 1912. Cold westerly winds had raised a heavy swell on this day, and just before nightfall penguins began to pass the ship in couples or small groups. They remained below the water most of the time, but their braying calls frequently attracted attention to sleek heads and upright tails, the only visible parts of birds at the surface.

Some of the Johnny penguin rookeries at South Georgia were on low ground near the sea, but the largest rookery that we discovered, comprising between four and five thousand birds, was distributed over knolls and ridges behind a great moraine-beach at the Bay of Isles. The site is bounded by two glaciers so that it can be reached only from the bay. In 1912–13 the penguin settlements, beginning half a mile from the water front, extended inland and up the hills to a height of about six hundred feet. As long as young penguins were on this nesting ground, processions of adults might at all times be seen coming and going between the high land and the sea. The birds met and passed each other without a visible sign of recognition, each trundling gravely along on its own business. A broad thoroughfare had been stamped across the moraine, worn down doubtless through generations of the pattering of little leathery feet, while deeply grooved, sinuous avenues extended up the long snowbank to the highest portions of the colony.

This type of rookery is common at South Georgia wherever high land is at all accessible. No matter how much available territory there may be near the water, no matter how wearisome the scramble up the hillsides, a certain proportion of the members of each colony selects as home the summits of the windy, shelterless ridges. Why should marine birds which lack altogether the power of flight, and which are at best indifferent walkers, prefer to make the period of propagation difficult for themselves by retreating as far as possible from their only source of food?

A consideration of the history of South Georgia may help in an interpretation of the strange instinct which drives the Johnny penguins to nest among the hills. The island is small, but its glaciers are as mighty as those of Spitzbergen, and there is ample evidence that it was formerly completely buried by an ice-cap. The interior, which rises to an altitude of more than six thousand feet, is no longer ice-clad, excepting on the peaks, but is covered with an everlasting névé of the Alpine type. This consolidates at the sources of all the valleys to form tongues of ice, most of which extend into the sea, ending in abrupt walls. Since most of the fiords have been carved out by former extensions of the valley glaciers, the coast is almost beachless, the few areas of low, flat land being terminal moraines or beds of moribund or extinct glaciers. Even

now, with the fluctuating seasons, the glaciers sometimes advance their fronts and flanks over considerable ground once abandoned, but in general glaciation is on the wane, and an appreciable decline has taken place even within a century. From such a condition it may be assumed that for a long period following the last ice-cap very little territory suitable for breeding purposes was exposed. Whatever bare earth existed must have been found along the ridges which separated the ice-filled valleys. During such a period these small penguins may have developed the trait which still leads them to seek lofty places for their nests. The fact that South Georgia was formerly the home of a far more abundant fauna than at present would have tended to fix the "mountaineering" instinct, for animals obtaining their sustenance only in the sea would have a tendency to increase more rapidly than the proportionate area of the beaches, and through sheer overflow of population many birds would be forced to content themselves with the less accessible ground, leaving the shores to great herds of summering seals, and the adjacent nesting-sites to powerful rivals such as the king penguins.

The faith which the Johnny penguins hold in the protectiveness of high land is strangely shown by their habit of running *away* from the water whenever danger threatens. Their terrible marine enemy, the sea-leopard, a large carnivorous seal, has fixed within the Johnnies an instinct which urges them to seek safety only on *terra firma*. Consequently they do not govern their acts according to their perceptions. Time and again I have seen a group of them standing at the water's edge when a fox terrier, brought ashore from the vessel, started toward them at a run. If the penguins deigned to show any fear at the approach of the barking dog they invariably responded not by taking to the water, where they would have been rid immediately of the tormentor, but by deliberately running *up* the beach, heading for the nearest bank or hillside. Even after the dog had seized a penguin by its bristly tail and had swung it round and round merely for the fun of

At a rookery of Johnnies

teasing, the poor dazed victim would still persist in scampering away from the water. I often found that the surest way to keep penguins ashore was to try to drive them into the sea.

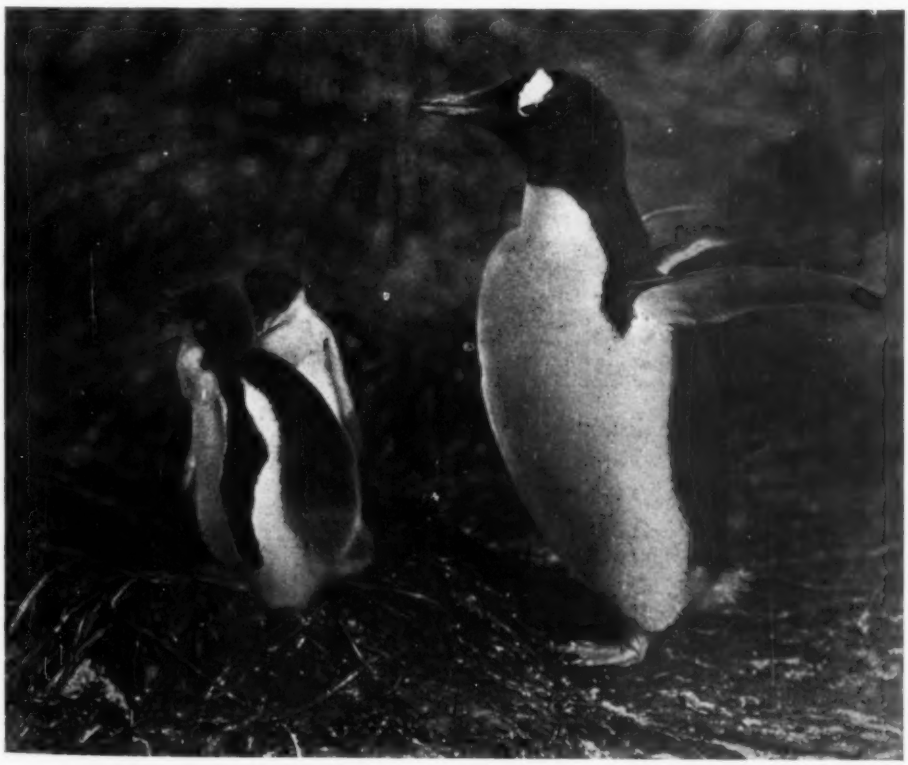
The antiquity of the hill-climbing instinct among the Johnny penguins is finally attested by a strange and romantic phenomenon, namely that the penguins go back to the seclusion of the heights to die. In a hollow at the summit of the coast range south of the Bay of Isles lies a clear lake on a bed of ice-cracked stones. This transparent pool, formed entirely of snow-water, with a maximum depth of twelve or fifteen feet, is a penguin graveyard. In January, 1913, I found its bottom thickly strewn with the bodies of penguins which had outlived the perils of the sea and had apparently accomplished the rare feat among wild animals of dying a natural death. They lay by scores all over the stony bed of the pool, mostly on their backs, with pinions outstretched, their breasts reflecting gleams of white from the deeper water. Safe from their two enemies, the sea-leopard in the ocean and the skua gull ashore, they took their last rest. For months, perhaps years, they would undergo no bodily change in their frigid graves.

Nesting Johnnies are generally timid, scampering off at the approach of a man, but never retreating more than a few paces. A small proportion of them stand their ground on the nests and show fight, employing as weapons both bill and wings. With the latter they can strike rapid and forceful blows. On one occasion a bird which I had roused from sleep attacked me and beat such a furious tattoo upon my leather leggings that its own pinions were soon bleeding. When a brooding penguin is driven away from young nestlings it lingers near by,

An adult Johnny with the first chick. Three or four days usually intervene between the hatching of the two eggs. Note the penguin's long tail pointing stiffly upward, and the white fillet which crosses the head

trumpeting loudly until the disturbance is over; then it examines its offspring very minutely, stooping down near-sightedly, and scrutinizing one and the other over and over again. When satisfied that all is well it settles down contentedly. The incubating birds turn about in their nests so as to keep their bills pointed toward the skua gulls, which walk about the rookeries with evil purpose and wait patiently hour after hour for a chance to steal an egg. Eternal vigilance is the price of safety for the penguins. The sitters hiss sharply whenever a skua draws near, and the free penguins make angry but vain rushes at the common enemy.

Besides the hiss of wrath the Johnny penguins have a variety of louder calls. The ordinary trumpeting note sounds like the noise of a tin horn or the braying of an ass; the sound is double, being produced by both expiration and inspiration, and is accompanied by a rising and falling of the lower throat. The voice is pitched in a much lower key than that of the king penguin. Usually the head is pointed upward while the penguin trumpets. The mouth is held wide open, with the spiny tongue showing, and the expelled breath condenses into clouds of vapor. The trumpetings are often repeated many times without interruption, and under excitement the bird's whole bodily energy seems to be put into the call. Another note is a short, single "caw," which the penguins are apt to utter as soon as they emerge from the sea. This call sounds like a hail from one man to another, and the human suggestion is enhanced by the penguins' habit of waving their flippers



A proud parent with two healthy, pot-bellied youngsters. The near young one is trumpeting

as if beckoning. The weak trumpetings of nestling Johnnies have a peevish, scolding quality, even hysterical at times. The youngsters have a soft, peeping note also, indicative of well-fed contentment.

By the middle of January the young penguins were mostly two-thirds grown, and their incessant chattering could be heard a long way from the rookeries. The older youngsters walked about in an uncertain, wobbly fashion, tagging after their fathers and mothers and trumpeting nervously when left too far behind. When I walked among the nests, all but the youngest chicks left them and herded together. The brooding adults too, rushed away, but a few squeaks from the abandoned little ones usually brought them back, scampering hither and thither and swinging their wings frantically. If the youngsters happened to be old enough to walk, the parents coaxed them along by giving small tastes of food, with promises of more, but in hysterical fashion they would soon forget to wait for their feeble babies, and would have to be called back repeatedly.

By the end of January all but a very few of the young penguins, still clad in the softest of gray and white "fur," had permanently deserted the nests and had congregated by themselves, but always under the guard of adult nurses. In fine weather they might be seen sunning themselves on the snowbanks, and at other times crouching from the wind in sheltered hollows. Some of them were as large as the adults, but they were still dependent for their food, and they had not yet been to the seashore. I often saw them pleading to be fed when the old birds evidently did not wish to gratify them. Such begging youngsters ran about after the adults, following every dodge and turn, continually bumping into them and stepping

The Johnny on the left has fallen and soiled his clothes. The white spot on the heads of these youngsters is the signal of the approaching molt

on their tails until the harassed adults gave up in despair. The young ones would then press closely against the provider, open their little bills expectantly, and lose nothing of the regurgitated meal.

About the first of February most of the young Johnnies begin molting their down, thus exposing the adult plumage feathers which have developed underneath the down. The down is shed in sheets and patches; the process resembles the peeling of the velvet from a deer's horn. By the middle of February, or toward the close of the molting period, clinging tufts, collars, or top-knots of down give the otherwise smooth young penguins the appearance of clowns and pierrots.

The molt of the nestling Johnny penguins is succeeded closely by the annual molt of the adults. Toward the end of February the feathers of the latter, already much faded and frayed, begin to drop out, still further to litter the ground of the rookeries. The molting season of the adults seems to endure all through the Antarctic summer. On March 12 I observed that a few of the adults had not yet begun to doff their old coats, which were brown, rough and threadbare. Many more, the majority of the birds in fact, were in the throes of the process and were exceedingly ragged, the new plumage showing in spots. Still others had completed the molt of the old body feathers, but still retained their long tails, while the most advanced birds had lost all their feathers including the tail, a temporary loss which gave them a more dumpy outline than ever; for appearance sake a Johnny can ill afford to be without its luxuriant caudal bristles.

The Johnny penguin has not in any degree the fearless and courageous disposition of its Antarctic cousin, the Adélie penguin. Bands of Johnnies along the beaches are prone to take alarm if a man appears suddenly among them. The most successful course of action is to approach them slowly, halting at a discreet distance and so inviting the penguins to take the initiative. They have a large bump of curiosity and will presently push the acquaintance, their familiarity increasing in direct proportion to the quietness and seeming indifference of the observer. A description taken from my notes of December 23, 1912, is characteristic. On the afternoon of this day I walked to a glacial pond on the far side of which stood a group of Johnny penguins. As soon as they saw me one of their number swam across under water and walked toward me. I remained motionless until it came up quite to my feet and stood there. When I moved quietly, it followed, and when I stopped, it did likewise. Then, one by one, it was joined by the other penguins from across the pond. It was whimsical to see this troop of mimicking small brothers with no other wish than to keep me company. I finally broke the spell by stooping to pat one on the head, when they all wiggled their tails, hurried back into the pond, and swam across like porpoises.

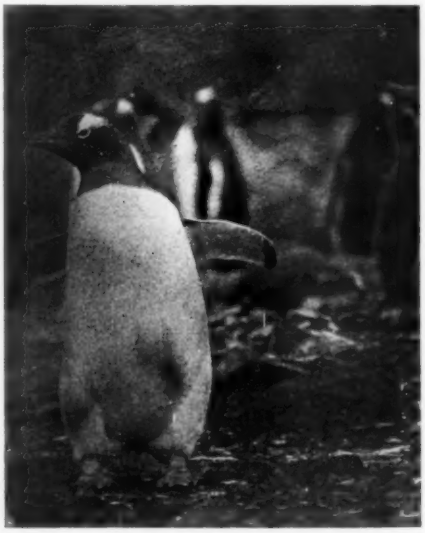
On March 12 I rowed ashore during a brisk snowstorm and found a whole army of penguins near the rookery at Possession Bay. They were standing by hundreds in a long double row along the beach. These rows marched forward to meet and surround me, and their numbers were continually augmented by new arrivals which kept popping out of the surf, and came running up the shingle as if much astonished to find me there.

The Johnnies walk in a deliberate manner, raising their feet high at each step, carrying their tails well above the

Off to sea! Relieved sitters setting their balancers and starting on the long walk to the water

ground, thrusting their wings behind them as balances, and poking the head forward into the accustomed near-sighted attitude. Their nearsightedness is probably no less real than apparent, because of the specialization of their eyes for vision through a medium of water.

In crossing the stony or hummocky beaches that separate various arms of the bays, or that lead from the sea to the snow-water ponds in which the penguins delight to play, they follow regular, well-tramped avenues. When bent on a definite journey across the land they trudge along very steadily and unconcernedly, and for the time seem to take no notice of their fellows. When in great haste they fall upon the belly and run on all fours. By this well-known mode of progression, called "tobogganing," they can lead a man a very creditable chase. Their most curious attitude is assumed when they walk down an incline, such as a snowbank or a steep beach. The head is then thrust so far forward that the straight neck and the spine form a right angle; the wings are held stiffly back as far as possible, and the round belly projects as the bird proceeds with gingerly steps. Their fat bodies seem to be made to stand hard knocks, for not only do they tumble over frequently wherever the walking is rough on shore, but they also suffer fearful batterings on the shingle when they come out of the surf, some-



A group of Johnnies — downy young "nurses."

times being bowled over by four or five successive breakers before they can scramble out of the undertow.

When wading into the water the Johnny penguins invariably round their shoulders, bend down their heads almost to their feet, and scoop beneath the surface as soon as there is depth enough to float them. Once under way, all their terrestrial awkwardness vanishes. They swim with well-nigh incredible speed, remaining below the surface except when they leap out porpoise-like, giving an audible gasp for air — to be gone again within the twinkling of an eye.

One evening I stood knee-deep in the water of the Bay of Isles and watched at close quarters four Johnny penguins swimming. The sea was fairly calm, the water clear and brilliant in the sunset light. The quartet of penguins darted hither and thither all about me, now and again almost brushing my legs. Frequently they rolled their backs above the surface, and more rarely they leapt out. I distinctly observed that the strokes of their flippers were sometimes made alternately and sometimes in unison. Probably they were feeding, although I could not see their prey. Whether for sport or a more serious purpose they occasionally swam in the ridge of an advancing swell, going so far up the beach that they were left stranded for a moment. Presently three of them walked out of the sea, shook the water from their tails and became so

and molters. **One is in the ecstatic attitude of trumpeting**

immensely interested in watching me, that they pursued me for a while when I left the spot.

On another occasion I witnessed an extraordinary diversion of the penguins in the graveyard pool already mentioned. This pond, lying in a hollow of the hills, was bordered on three sides with a perpendicular bank of hard snow, the remaining shore being a stony slope. On the afternoon of my visit penguins were swimming in it, for pure enjoyment of course, for there was no food, no living thing, not even a visible alga, in the transparent snow water. How alert and reptilian the penguins seemed in their own element! How unlike the inelegant, ridiculous creatures they are ashore! They dashed straightaway under water the length of the pool and back again, with a velocity which I had then an opportunity to compute as about thirty feet a second. They chased each other round and round, flashing into the air twice or thrice during their bursts of speed, every action plainly revealed through the clear, quiet water, with the white dead birds down below them. When the swimmers rested at the surface, only the white-filleted head and up-pointed, ridged tail showed, as a rule, but sometimes they would float higher, like grebes. Several of them tried to leap out onto the bank of frozen snow which rose a yard above the water. Strangely enough they misjudged their distance repeatedly; they jumped too soon, and were on the downward segment of their arc before they had cleared the edge. I saw one individual try a dozen times and fail; it always leapt a few lengths too soon and whacked its shiny breast against the wall of ice. A group of birds, which had been sunning on a snow bank, entered the water as if by mutual agreement. Some of them walked to the rocky slope and waded, arching their necks and tucking their heads under water before they made the plunge. Others flopped off the edge of the ice. I say flopped because they did not make graceful standing dives, such as I had expected; on the contrary they entered with flagrant, splashing "belly-whoppers." The great discrepancy between the Johnny penguin and the Adélie penguin in jumping and diving ability is at first sight rather surprising. Through the medium of the films taken during the Australasian Antarctic Expedition I have seen the prodigious, salmon-like leaps of the plucky little Adélies, while the photographs of Scott's Expedition well illustrate the graceful dives of these denizens of polar shores. It must be borne in mind, however, that the Johnny, with a Subantarctic range, breeds on no land which has an ice-shelved coast. The ability to gain the land by a catapultic spring has doubtless vanished with the disappearance of the necessity for such a method.

The Johnny penguins often feed far at sea, but during the long breeding season they apparently all return to the land for the night. In late afternoon we usually saw long troops of them "porpoising" into the fiords from sea. This habit is so well known that sealers, overtaken in their boats by an impenetrable South Georgian fog, rely upon the home-coming penguins for the direction of the flat beaches.

Considering the fact that most marine birds swim as soon as they emerge from the shell, the tardiness of young penguins in taking to the water has been pointed out as a remarkable phenomenon. The explanation of this, however, is doubtless that the speed and stamina required in capturing living pelagic food, in escaping from the dreaded sea-leopard, and in swimming through breaking surf, cannot be developed early in life by birds which

use the *wings* instead of the feet as propelling organs. Certainly the pinions of nestling penguins seem extraordinarily underdeveloped. The little birds begin to exercise them soon after birth by flapping them, weakly at first but vigorously later on — a trait that suggests ancestral aspirations for flight. On many occasions I put nestlings of various ages, as well as fully grown, molting young, into the fresh water ponds, where they proved themselves almost as helpless as human beings unfamiliar with swimming. They instinctively put their heads under water and tried to swim below the surface in the approved fashion, but it was a feat quite impossible for them. They beat the wings simultaneously, and bobbed up and down without making much progress. Such a scene always attracts a band of skua gulls to the spot, as if these ogres realized the helpless misery of a young penguin in the water. The skuas do not strike while their prospective victim is swimming, but pace along the shore waiting to intercept its landing. Once a half-grown youngster, with which I had been experimenting, crawled out of the graveyard pool into the very jaws of seven skuas which attacked it *en masse*. The little penguin struck with its feeble wings and cried out piteously. Insignificant as it was, not one of the skuas dared seize it outright, but they made quick rushes from all sides, striking the penguin on the head with closed bills, and then retreating. I hurried to the rescue and restored the little bird to its nest where I afterward saw it resting characteristically with its head hidden between its mother's warm feathered thighs.

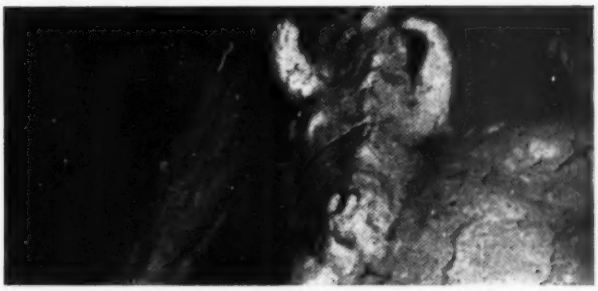
[Story of King Penguins in next issue of JOURNAL]

A group of king penguins. Above is Lucas Glacier named by Mr. Murphy in honor of the director of the American Museum of Natural History

After Max Begouen in "L'Anthropologie"

BISON IN CLAY, TUC D' AUDOUBERT CAVE

Representations in clay of male and female bison, found at the inner extremity of the Tuc d'Audoubert cave, on the estate of Count Begouen, near Saint-Girons (Ariège), France. The figures are each about two feet long and are the only known examples of clay-modeling dating from palæolithic times. Except for the cracks due to drying of the clay, the broken tail of the cow and the horns of the bull, the figures are in perfect state of preservation



EUROPEAN CAVES AND EARLY MAN

By N. C. Nelson

INTRODUCTORY NOTE: The American Museum is one of several institutions in the New World to maintain an active interest in palæolithic archæology as developed in Europe. At the present time, for example, a comprehensive display indicative of this earliest of art and industry is open to the public. With the addition of a much-needed somatological series the exhibit would give the visitor a surprisingly complete ocular demonstration of man's origin and of the various steps in his physical and mental history.

In order to make clearer to the general public the binding nature of modern conclusions regarding early human developments it was decided some time ago to construct a model of a palæolithic cave station. The station selected as most instructive for this purpose was the Castillo grotto, in northern Spain, there being preserved here in forty-five feet of distinctly stratified deposits the whole industrial history of man almost from the earliest beginnings down to the introduction of metal. In connection with this project, which was inspired largely by the interest of Henry Fairfield Osborn, president of the Museum, the writer had opportunity a little over a year ago to examine a large number of the palæolithic stations in western Europe and the following general remarks are based on observations then made.[1] — N. C. N.

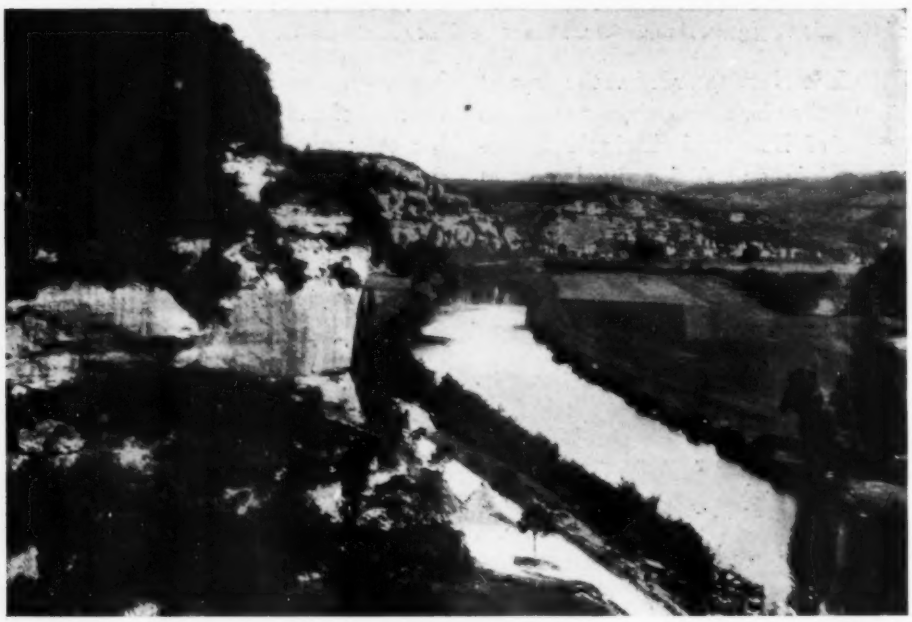
THERE are recorded at the present time for the southern two-thirds of Europe, including Mediterranean Asia and Africa, no less than four hundred palæolithic stations, that is, places where remains of one kind or another have been left behind by early man. This man was primarily a hunter and his chief center of activity appears to have been what is now southwestern France and northeastern Spain although Germany, Austria, Italy, Belgium, England, and to a lesser degree other countries, came within his range. This apparent distribution may be deceptive however. Many of the stations are out in the open, as for example on the valley terraces of the Thames and the Somme; but the majority of the sites, especially those of later times, are sheltered in some way. The shelter may consist merely of an overhanging cliff, it may be a grotto yawning on the mountain side and it may be the far interior of a cave. This latter type of site it is relatively easy to find by making a deliberate search while the location of an ancient camp or workshop in the open country is the result only of chance. It is conceivable of course, that these roaming migratory hunters returned seasonally to the natural shelters, but on the other hand, it is possible that many of them built huts — some of the geometric cave paintings suggest that they did — and unless these huts stood in very close proximity to

[1] The geographical distribution of important caves and shelters, the cave art and the palæolithic industrial remains were considered in the JOURNAL issues of December, 1912 and October, 1914.

some sheltering cliff, all traces of the spot and its relics would be lost. Hence, we may properly take for granted that hundreds of archæological stations will remain undiscovered, in consequence of which our notion of the actual strength of the population at any given place during these early millenniums of human existence must continue imperfect, if not inadequate.

As need hardly be stated the presence of natural habitations depends ordinarily on a high relief or a more or less mountainous topography. Caves are most abundant in volcanic regions as in the western United States or in limestone areas such as Kentucky and adjacent commonwealths. Shelters are notable features of steep-walled valleys or box-cañons and our own cliff-dweller region affords the best example of them and their utilization. In Europe the most famous cave groups are located in the lower French Pyrenees and their Cantabrian extension in northern Spain, while the equally famous shelter region includes short sections of the Vézère and Beune Valleys at Les Eyzies, in the French department of Dordogne. Both regions are wonderfully picturesque and impressive and barring some alterations in the flora they have not changed much in general appearance since the arrival of palæolithic man. These caves and shelters are all in limestone formations and are the results chiefly of mechanical erosion. Some of the caves, especially those of the lower altitudes, are still in process of making, while others, well up on the mountain sides, are very ancient — in fact, were in their old age when man first entered them.

Roughly speaking, the shelters proper, that is the overhanging cliffs and the wide open grottos, were the homes of palæolithic man and therefore naturally furnish us with important data concerning his physical make-up, his practical



The Vézère River, its floodplain and cliff wall as seen from the entrance to the Gorge d'Enfer, above Les Eyzies, France. The station of La Micoque is on the extreme right, Laugerie Haute at the foot of the distant cliff and Laugerie Basse nearer by off the first bend in the stream

ability, and the general nature of his everyday life. The caves, on the other hand, served him mainly as galleries for a remarkable series of paintings, engravings and carvings, which in a measure reveal to us his mental attitude toward life. The caves, it must be understood, were exceedingly dark and damp, ordinarily unfit for habitation, except possibly as temporary retreats during the hard winters, and contrariwise, the shelter walls, having been exposed for thousands of years to the weathering elements, could not have preserved for us either paintings or delicate engravings that may have been made upon them. There are several somewhat qualifying exceptions to these sweeping statements however. For instance, the Gargas Cavern near Montréjeau, France, and likewise the Altamira Cave, near Santander, Spain, appear to have been occupied for protracted periods although in both cases only very close to the entrance. On the other hand, some of the shelters such as Cap Blanc, near Les Eyzies, France, have preserved, mainly through accident, a fine series of high relief sculptures. But as a general thing the camp-sites are in large half-open shelters, usually facing the sun, while the entrances to the painted caves face in any direction and for the most part are very small and inconspicuous. At Castillo only there is the perfect combination — a large sunny grotto which was occupied periodically throughout most of palæolithic times and which

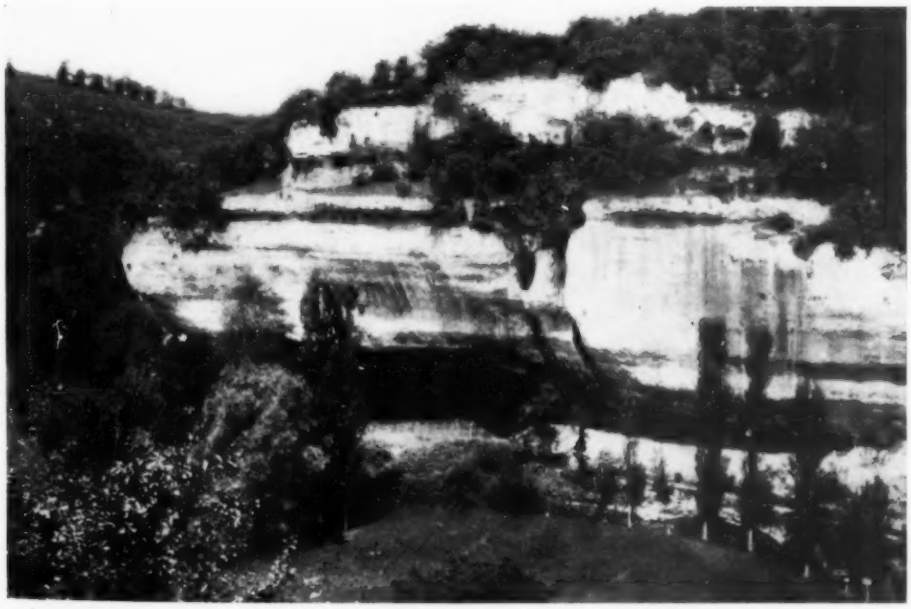
Entrance to the cavern of Tuc d'Audoubert near Saint-Girons, France. A stream still issues from this cave, which is the most beautiful and in a way the most interesting of all the known Pyrenean haunts of the ancient artist who has left here not only mural engravings but also models in clay and even his footprints

served besides as the vestibule to a considerable cave, famous for its mural art.

An examination of the various Dordogne shelters coupled with a study of the changing types of objects found in them is most instructive. Nearly all of the stations here are at the base of the high cliffs that hedge the narrow valleys on one or both sides; but in a few instances the relic-bearing débris lies on an eroded ledge some distance up the face of the protecting wall. Almost within earshot of Les Eyzies are a series of stations which taken together furnish data on human history practically from Acheulian times to the present day. These stations begin with the old obscured shelter of La Micoque, include the partially-ruined shelters of Upper and Lower Laugerie; another ledge-shelter that served old-time brigands as a rendezvous and also as a fortress to defy the English in 1410; still another ledge marked by ruins of what looks like some old baronial château; and end up finally with the more or less well-kept houses of the modern peasant. These houses often stand on several meters of ancient relic-bearing débris and seem to cling in an infantile sort of way to the overhanging cliff in spite of its cold damp nature. Some distance up the Vézère, at the Rock of St. Cristopher, where the last houses have been removed, there are over four meters of débris dating from neolithic to present time and the adjacent cliff is marked by several series of parallel holes, cut for the insertion of ceiling beams, precisely as we find them in our own Southwest. Some of these holes are high up the cliff but others are below the surface of the accumulated débris which is itself below the high-water mark of the river.

Anniversary occasion (July 20) of the discovery of the Tuc d'Audoubert cavern. The amiable Count Begouen is seated in the center while behind him and on the extreme left are his three enthusiastic sons who made the discovery of the famous modeled bison. Professor Emile Cartailhac is seen to the left of the Count and on the right are two French zoölogists, students of the cave fauna

Laugerie Haute, showing present-day dwellings built against the cliff. Beyond the houses a tremendous overhang which once sheltered Aurignacian and Solutréan people has dropped down, burying possibly some of the ancient inhabitants



The ideal shelter, Grotte d'Enfer, was probably not occupied as long as might be supposed as it was subject to floods

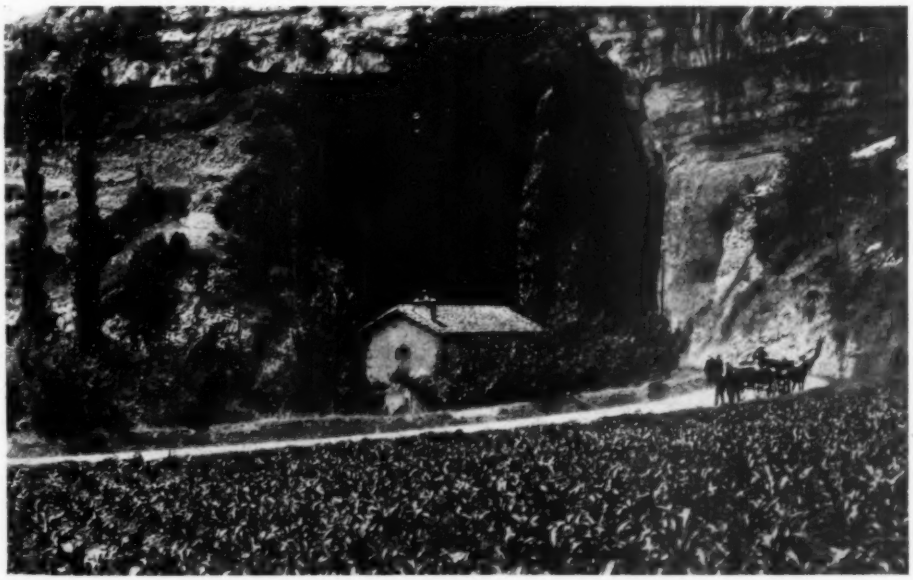
With all this evidence suggestive of continuous occupation, it is not to be wondered at that some students profess to see among the local inhabitants a number of individuals that resemble the physical type of palæolithic man.

A visit to the painted caves is the experience of a lifetime; but while it is an adventure bound to excite more enthusiasm than the examination of the shelters, it is less instructive and certainly less convincing. It is also an undertaking fraught with some difficulty and disappointment, except perhaps in such cases as Altamira, Niaux and Font-de-Gaume. The painted and incised representations on the cave walls are seldom so plain and striking as one might infer from the superb reproductions in the published reports, and to make them out the visitor must take time. In this effort to decipher, he is most ably assisted by Professor Emile Cartailhac of Toulouse, who has given a good part of his life to the study of palæolithic art and who at present guards nearly all the Pyrenean caverns. In Spain and in the Dordogne country, however, local guides must be taken and as these are not always competent, the student who would profit by his opportunity must prepare himself beforehand in regard to what is to be seen and then insist on being shown, or he may not see much.

The last cave to be discovered and also the most beautiful is the Tuc d'Audoubert, located on the estate of Count Begouen near Saint-Girons, France. This is perhaps the most difficult cavern to explore. But to risk passage in the improvised boat that the visitor must sail in order to reach the interior, and to crawl on his stomach along muddy passages that are really too small for a full-grown man, and finally to receive innumerable bumps on his head from pending stalactites is not too much to

Valley of the Rio Pas at Puente Viesgo, Spain. Over half way up the farther side of the prominent peak on the left is the cave of La Pasiega and a little lower down on the side facing the river (within view) is the famous Castillo cave and Grotto where man lived periodically almost from the earliest stone age down close to historic times

Outlook from the Hornos de la Peña cave. Not a human habitation is in sight and the rugged semi-forested country is still the home of the wolf, the bear and the wild boar



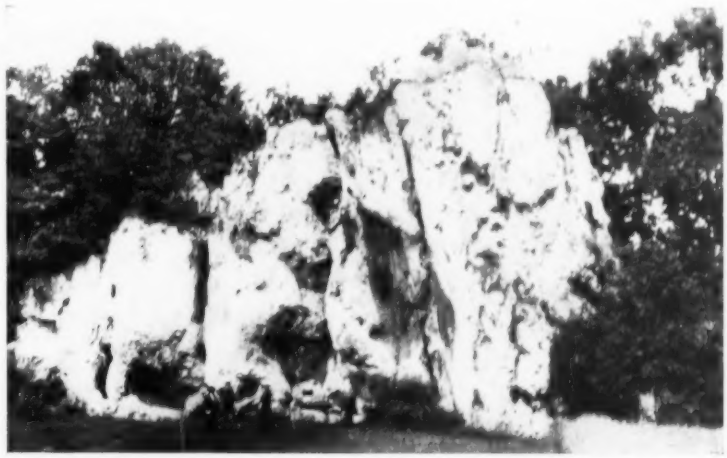
Upper entrance to the Mas d'Azil cavern, near Foix, France. The Arize River has here tunneled a high rock formation about one-fourth of a mile thick and which now accommodates the public road. Within the 200 foot-square entrance, on the left bank, is the ledge which was occupied in Magdalenian and Azilian times. In the interior are immense galleries also rich in archæological material, but now the home only of thousands of screaming bats

Entrance to the Pindal cave, north coast of Spain not far from Colombres. The people are standing on the fallen roof of a long sea passage in the rock which when the entrance was choked permitted the cave behind it to silt up and become an art gallery of considerable note. Professor Henri Breuil is on the left and the second from him is his colleague, Professor Hugo Obermaier.

The upper photograph shows the view seen from the entrance of the cave. Stratified limestone stands nearly on end and the waves have cut out long passages in the softer strata

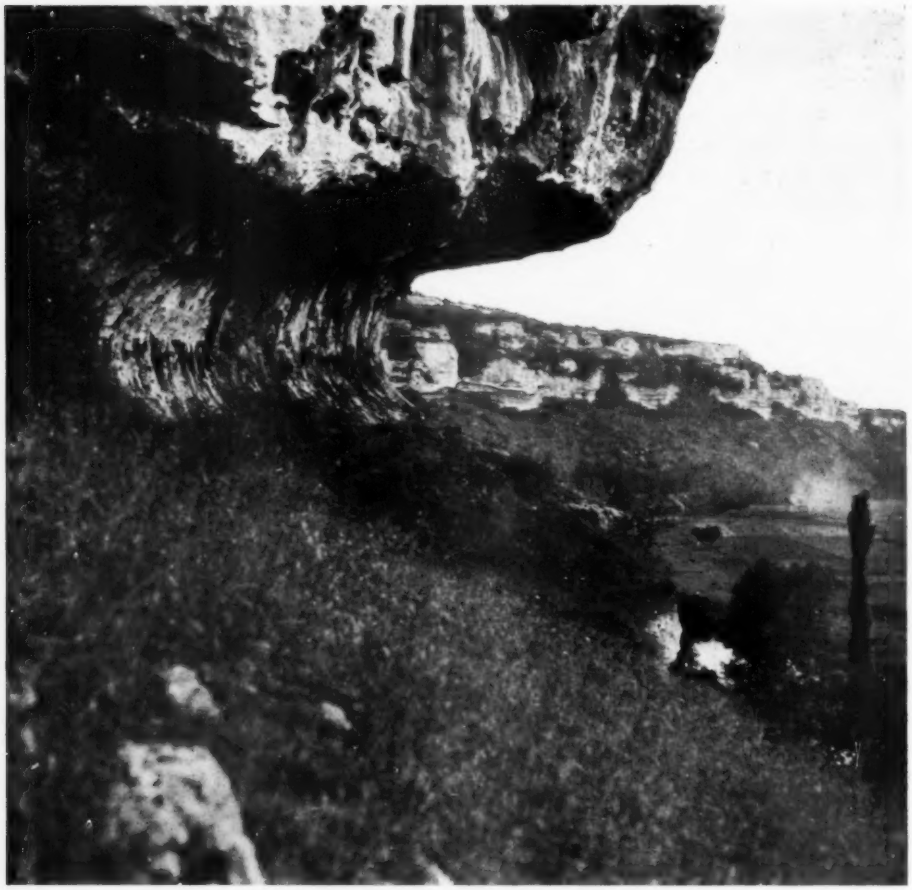
pay for the privilege — which, as it happened, was accorded the Museum's representative as the first American — to see the wonders inside. Ordinarily, the natural wonders of the caverns are more or less discolored with mud, but here is gallery after gallery of bewildering forests of pillars and pendants and posts — all a pure white and glittering as if studded with myriads of diamonds. Here and there the stalactites hang in large sheets like folded draperies and by placing a light behind them the translucent substance flashes up into colors of green and rose too beautiful to be described. No fairy palace was ever more adorned! You are led along devious passages, stepping again and again in lakelets of invisibly clear water and when on dry footing you are warned to move circumspectly for fear of obliterating some ancient human footprints that are faintly visible under the thin coat of stalagmite which covers the clay floor. Bones and skulls of the giant cave bear and other animals lie all about, cemented in place. Finally, near the extreme inner end of the cavern comes the real object of the laborious journey, viz., the representations of two bison (male and female) modeled in clay. The figures which are about two feet in length, are propped against the sloping side of a rock which rises from the floor, and in front of the animals on the floor there are some tracings as if the artist had here sketched and improvised before beginning his real work. About twenty-five feet away in a low side chamber is to be seen the place where the modeler scraped together the clay off the floor and kneaded it. Two or three worked rolls of his material still lie there. The whole thing looks as if done a week ago and yet the bison has been absent from the locality probably for thousands of years.

The last suggestion of skepticism is in keeping with the general impression that the visitor retains from the painted caves. It is a most baffling experience. When the investigation is confined to the stratified deposits everything is beautifully simple. Art objects have a definitely ascertainable place in the series and go back to Aurignacian times. The cave art proper is of the same general style as that of the stratified refuse and must of course be of the same date; moreover, the animals represented are in nearly all cases either extinct or absent from the region. And yet almost all the mural



The Schweizersbild station near Schaffhausen, Switzerland. This limestone excrescence rises abruptly from a meadow-like spot, and in its shelter — facing approximately west — people lived in Magdalenian times. Dr. Jakob Nuesch, who gave three years to the investigation of the site, stands on the right

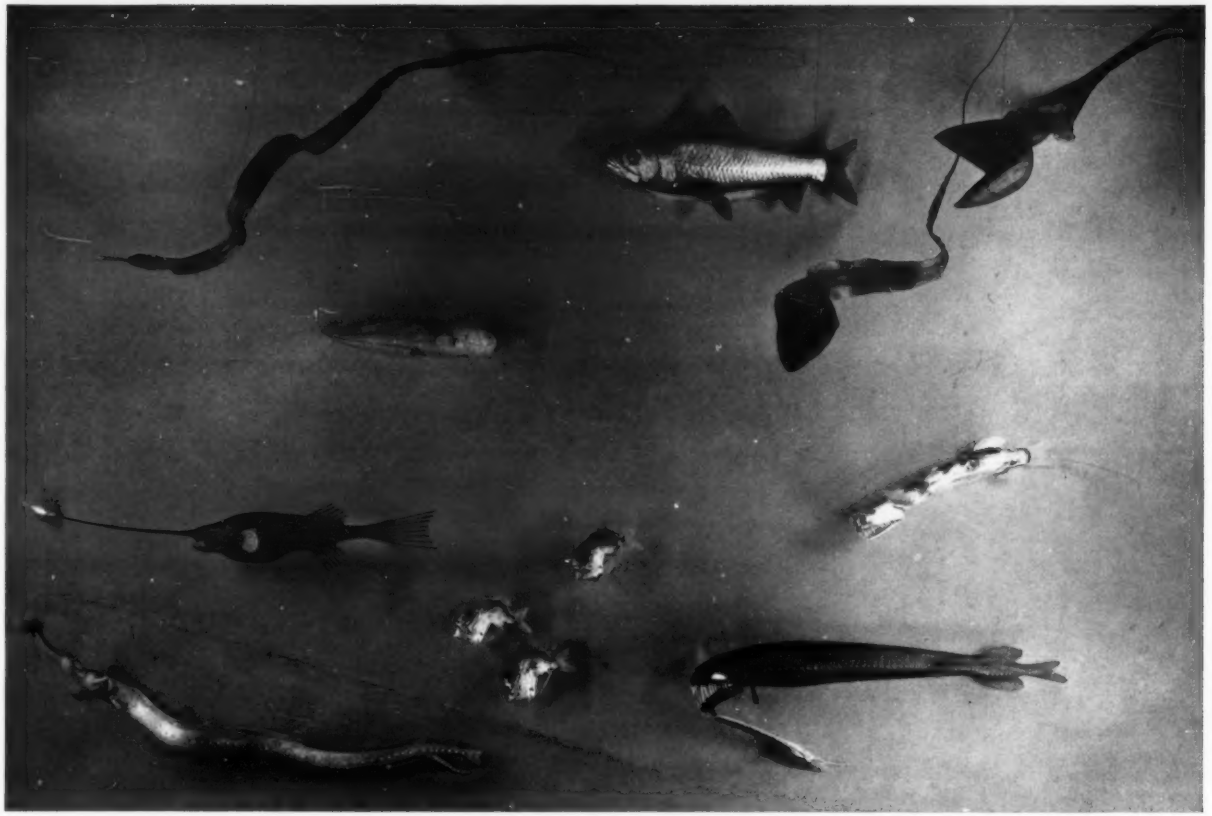
figures in the caves are within reach of the hand. In other words, the caves have undergone no particular changes since the artist did his work. Not a few of the paintings, and especially the finer engravings seem as fresh as if done yesterday. In the Pindal cave is the representation of a fish incised on the wall and the visitor who examines it closely would swear that he could make a line exactly like it with a lead pencil, but with Professors Breuil and Obermaier standing behind him he says nothing. And how did palæolithic man manage to get about in these caves? It is unsafe to move ten steps in them without a light. It is true that a very few stone basins have been found that may have served purposes similar to the Eskimo lamp, or the artist's right-hand man may have carried a torch; but there are no signs of such torches or of carbonization on the walls in the vicinity of the paintings, although smoke spots made by modern lamps and candles held too close are abundant enough. The conviction that this cave art is not so old as some would have us believe seems irresistible.



A weathered indentation in the limestone cliff such as served to shelter early man. Looking down the Vézère Valley from the point of its junction with the Beune Valley, at Les Eyzies, France. Several caves are to be found in the distant cliff and on one of its high sheltered terraces there is the interesting ruin of a church dating from the early Christian era

There are other difficult problems relating to palæolithic culture though none so seemingly baffling as those pertaining to the cave art, but these cannot be dealt with at present. Meanwhile the skeptic may take some consolation in the fact that Professor Cartailhac and his French colleagues were themselves doubters for over twenty years.

Section of relic-bearing débris recently exposed at Le Moustier shelter near Les Eyzies, France. In the face of the natural matrix may be counted hundreds of worked and unworked reject flint flakes



SOME DEEP-SEA FISHES

Some characteristic types of fishes found in the profound depths of the sea, half a mile or more from the surface, photographed from a group recently installed in the hall of fishes in the American Museum. The illumination of the group is so adjusted that the fishes are seen first for a few seconds in full light, and then in darkness as they are supposed to appear in the sea, lit up only by their own phosphorescent organs

The specimens are models, mostly enlarged several times the natural size. The fishes were prepared by Mr. F. F. Horter of the Museum's department of taxidermy, under the direction of Dr. L. Hussakof

FISHES OF THE DEEP-SEA

By L. Hussakof

UP TO the time of the "Challenger" expedition, very little was known regarding the fish life of the abyssal depths of the sea. Only about thirty species were known. But the wonderful collections brought back by the "Challenger" from her four-year cruise (1873–1876) made known the vast diversity, the strangeness and even weirdness of this fish fauna. Several hundred kinds of deep-sea fishes had been collected — some of them dredged from a depth of more than a mile — and it required a huge quarto[1] to describe and picture them. From this volume dates our real knowledge of the fishes of the abyssal deep. The "Challenger" expedition was, indeed, a "Columbus voyage" in ichthyology; it opened a new chapter in the history of the science.

Since that time many deep-sea exploring expeditions have been sent out by the various nations, and hosts of other fishes have been brought up from the oceans in all parts of the world. More than a thousand species are now known, and we can appreciate at its full value the richness and strangeness of this fauna. Moreover, not only do we know the fishes themselves, but as a result of the scientific investigations carried on by the various expeditions, we now know a good deal of the physical conditions under which they live, so that we can, in a measure at least, explain the why and wherefore of their extraordinary characteristics.

When we think of life in the deep-sea, there comes to mind, first of all, the enormous pressure which these creatures must withstand. This pressure becomes the greater the deeper we go down, and in the profoundest depths it equals thousands of pounds to the square inch. The result of this pressure is that the tissues of these fishes are tender and loosely knitted together. When they are brought up out of the dark depths, and the great pressure under which they live is removed, the explosion of the gases within them bulges out the eyes, and often blows out the viscera through the mouth, while the muscles collapse, leaving them soft and flabby like moist rags. Most deep-sea fishes are very small also, usually only a few inches in length, and it is probable that this reduction in size has come about to some extent at least, from the great pressure under which they live.

Another important condition is the dimness of light, or even darkness in the profound depths of the sea. If we imagine ourselves descending into the deep ocean, we see the light grow dimmer and dimmer as we go down, until finally a level is reached beyond which no light penetrates at all. The entire vast depth below it, is in eternal darkness. Now the fishes living in this dim light, or in total darkness, have been profoundly modified by it. In some forms the eyes have become very small, and in some cases have entirely disappeared. There are even fishes in which the skin and scales of the body have grown over the place where the eyes should be, so that these fishes are, as has been aptly said, "blind beyond redemption." Other forms, on the other hand, have been affected in an entirely different way. The eyes, instead of growing smaller, have grown larger, as if in an attempt to catch every fleeting ray of light. In

[1] *Challenger Reports*, Vol. XXII, 1887.

some fishes this has been carried so far that the eyes have become like enormous goggles.

Most deep-sea fishes have luminous organs of one kind or another, so that they carry their own light about with them. In some the entire body glimmers, the coating of slime which exudes from the pores and lateral canals, emitting a soft silvery glow. In others, rows of minute, luminous organs run along the sides of the body, or there are flashing light-spots on the head or face. What a wonderful sight would be to us a small black fish flitting through the silence and darkness of the deep with its headlights and row of pores gleaming through the darkness like some small ship passing through the night with its portholes all aglow! Some deep-sea fishes have a luminous organ at the end of a feeler on the head. This is waved to and fro to act as a lure to attract the prey.

A pertinent question may be asked: How do we know these fishes glow and glimmer, since no human eye has ever beheld them in their abyssal home? We know this partly from analogy and partly from actual observation. When one is in a boat in the tropics, on one of those sultry nights when everything is a dead calm, and the black clouds hang so low that sky and sea form one continuous blackness, then one may see the glimmering fishes darting out of the path of the boat, their forms, silvery and ghostlike, outlined for one moment against the blackness of the sea. This effect is chiefly due to the oxidizing of the slimy secretion covering their bodies. Why shall we not believe, then, that in deep-sea fishes a similar phenomenon takes place, particularly as in many of them, the slime pores and canals are greatly developed and must exude large quantities of slime? Then too, on deep-sea expeditions, on favorable occasions, as for instance, a dark calm night, fishes that have been brought to the surface and placed in water were seen to flash light from the ends of the tentacles or the phosphorescent pores, precisely as we should have expected from a study of these organs. Major Alcock, in his interesting volume, *A Naturalist in Indian Seas*, mentions a specimen brought up from a profound depth which "glimmered like a ghost as it lay dead at the bottom of the pail of turbid sea-water." So that by inference, as well as by actual observation, we must believe that what we call luminous organs in deep-sea fishes, emit light into the darkness about them. In the case of fishes totally blind, the absence of light is compensated for by the development of enormous antennæ-like feelers, modified from fin rays, so that these fishes can feel their way, as it were, through the darkness.

The absence of light however entails another important consequence. As is well known, no plant life can exist in darkness. There is, therefore, no vegetation of any kind in the profound depths of the sea. The deep-sea fishes are, in consequence, all carnivorous, the more powerful ones seizing and devouring the weaker ones. It is a cold black world where might reigns supreme. Many have enormous mouths, and formidable teeth to insure holding the prey. In some forms the teeth are so large that the mouth cannot be shut! Moreover, since meals are perforce far between, they must be as large as possible; hence many forms have extraordinarily capacious stomachs. Specimens have been dredged from the deep which were enormously distended through having swallowed fishes larger than themselves.

The temperature of the water in the profound depths of the sea, is always low

and near the freezing point. This is true everywhere, even at the equator. Undoubtedly this has an effect upon the fishes, although it is not yet known what it is. The amount of oxygen dissolved in the water also, is much less than in water nearer the surface. The breathing apparatus of the deep-sea fishes is modified to suit these peculiar conditions. The gill filaments have become much reduced in size, and in a number of instances some of the gill-arches bear no gill filaments at all. The fishes are apparently adapted to a much smaller oxygen supply than those living in rivers or in the shallow sea.

When we think of the vast diversity among these fishes, the question arises: Are they all representatives of a single family, or group that has become specially adapted to life in the deep sea; or do they belong to different families or groups? One need hardly be an ichthyologist to answer this question. Even a cursory examination of the plates in a work on deep-sea fishes will show that different types are represented. In fact, a great many families are included in the deep-sea fauna. There are sharks and rays; salmonoids, herrings, perches, eels, and representatives of many other families. We can explain this heterogeneity among them in this way. We may imagine that fishes of many different kinds in their search, so to speak, for the unoccupied corners of the sea, found a haven in these deeper waters where they were free from pursuit by their enemies. In the course of time they migrated farther and farther into the deep, a change in habits taking place *pari passu* with the changes in structure. Having started out with different organizations, and possessing different degrees of variability, they became differentiated in diverse directions, so that while some developed enormous mouths, powerful teeth, or phosphorescent organs, others became bottom-living and partly or completely lost their eyes. Still others developed long feelers for groping their way through the darkness. Now and again however, fishes of separate groups developed similar structures, so that there are many striking cases among deep-sea fishes of what the biologist calls "convergence," or parallelism.

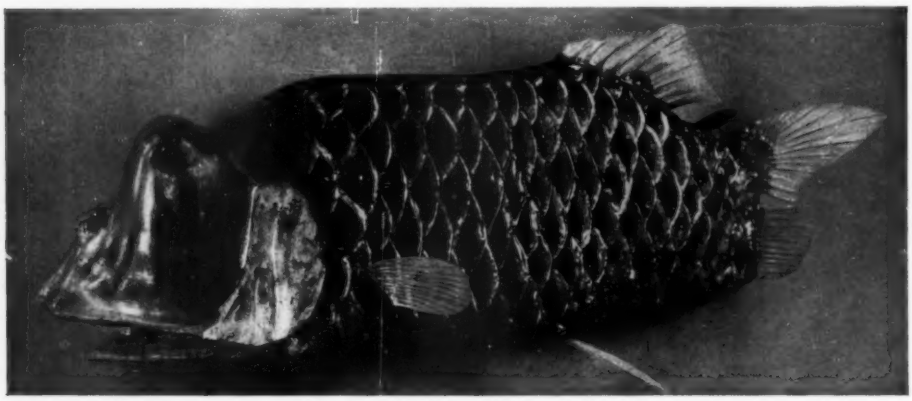
The Museum has recently prepared for exhibition a number of typical deep-sea fishes arranged in the form of a group. The preparation of this exhibit involved many technical difficulties, such as the modeling of the fishes in transparent or translucent media, to represent them as glimmering or shining with lit-up "portholes." Considerable experimenting was necessary to accomplish this group, but all the difficulties were overcome, thanks to the ingenuity and perseverance of Mr. F. F. Horter of the Museum's taxidermist staff. The group, as it is now installed, represents ten types of deep-sea fishes. It is not, of course, a group in the sense of the habitat groups displayed in the Museum; it is not a section, so to speak, taken from nature and transplanted to the Museum. In nature so many deep-sea fishes are not to be found in so small a space. What the group represents is a number of fishes which are in nature scattered over a vast area and through a great height of water, here brought together for museum purposes into a few square feet of space. Each fish is reproduced accurately with its phosphorescent pores and tentacles as these are known to exist. With one or two exceptions they are enlarged several times, as the fishes themselves are very small. And since it is known that the phosphorescent organs do not glow with a steady light, the illumination of the

A small, silvery, eel-like fish which has been found in all the oceans at depths ranging from a little less than a mile to two and one-half miles. It has a row of luminous pores running the length of the body; and in the blackness of the profound depths it must appear like a miniature long dark boat with gleaming portholes. Its greenish, glittering eyes are perched on the ends of slender, hornlike tentacles — a feature which has suggested its scientific name, *Stylophthalmus paradoxus*

group has been arranged so as to have these luminous organs flash intermittently. Furthermore, the installation is arranged so that one may view the fishes for a few seconds in full light, as if in a synoptic exhibit, and then see them, when the light goes out, as they are supposed to appear in the darkness of the profound depths, lit up only by their own phosphorescent organs.

Near the top of the group is seen a fish which lives on the border line between the region of dimness and total darkness. Many of the fishes living in this region are not of a uniform sombre hue, but are brilliantly colored. *Neoscopelus* is one of these. The body is "one dazzling sheen of purple and silver and burnished gold, amid which is a sparkling constellation of luminous organs" (Alcock).

The glowing fish in the center is *Barathronus diaphanus*, a small fish known from a single specimen, which



In this deep-sea fish the head glows with a soft pale light, while the body is quite dark, being covered with large opaque scales. The species (*Opisthoproctus soleatus*), is known by only two examples dredged from a depth of two and a half miles; one off the northern, and the other off the western coast of Africa

[This specimen is not shown in the general photograph of the group, having been cut out for convenience in reproduction. It is situated in the group below the bottom fish on the right hand side]

was dredged in the Indian Ocean at a depth of a little over four-fifths of a mile. The model of it is one and one-half times the natural size. The phosphorescent fish with the curious long tail (at the right) is *Gigantura chuni*. It, also, is known by only a single specimen. This was brought up from a depth of four-fifths of a mile in the Gulf of Guinea, on the west coast of Africa. The model is twice the natural size.

The two dark fishes with enormous gaping mouths (near the top, at the right) are *Gastrostomus bairdi*. This species is commoner than some of the others, a number of specimens being in several museums. The models of it in the group are copied life-size from a specimen in the Museum. The species occurs in the Atlantic Ocean, near the American coast, in the path of ocean liners. Specimens have been dredged from a depth of nearly three miles.

Near the bottom of the group at the left-hand side, is seen an eel-like fish with a line of lit-up pores. This is an enlarged model of *Stylophthalmus paradoxus*, a small silvery fish widely distributed in all the oceans, whose young also are known. The generic name it bears was given it in allusion to the fact that the eyes are perched on long slender tentacles. The species ranges from a depth of a little less than a mile to two and one-half miles. Another form with tentacles is *Gigantactis vanhæffeni*, a species typical of many deep-sea fishes which have a tentacle, terminating in a luminous organ, attached to the head. This tentacle serves as a lure for attracting prey. The present species is known by only two specimens which were found in the Indian Ocean at a mile and a mile and a half from the surface. The creature is a very small fish, the model being enlarged six times.

This strange deep-sea fish (*Gigantura chuni*) is known by only a single specimen dredged from a depth of four-fifths of a mile, in the Gulf of Guinea on the west coast of Africa. The body of the fish is a shimmering glow of iridescence, while the protruding eyes shine like automobile headlights. The formidable teeth mark it as a ferocious carnivore

VOLCANOES OF THE LESSER ANTILLES

OBSERVATIONS ON THE PRESENT CONDITION OF THE ACTIVE VOLCANOES OF MARTINIQUE, ST. VINCENT AND GUADELOUPE[1]

By Edmund Otis Hovey

MT. PELÉ and the ruined city of St. Pierre at its base hold chief interest on the island of Martinique. The old summit plateau of the volcano is 4050 feet above the sea. This formerly bore the pool of fresh water known as "Lac des Palmistes," but there is no trace now of the old lake basin under the coating of ten to fifty feet of new ash that covers the plateau. The new cone, which stands as the enduring monument of the great eruption of 1902–3, nearly fills the old crater adjoining the plateau and rises some five hundred feet above it. The famous spine, or obelisk, which rose more than six hundred feet farther into the air, disappeared nearly ten years ago through disintegration, and the cone as viewed from the sea, presents a flat top, whose apparent smoothness does not prepare a visitor for the actual ruggedness of surface which he finds on climbing the mountain.

In 1908 when I last visited Martinique the new cone was seamed with fissures which discharged great volumes of steam and gave temperatures as high as 500 degrees C. (932 degrees F.). Considerable steam is still issuing from these vents, but there are no temperatures exceeding 100 degrees C. (212 degrees F.). The fumarole area and the plateau on the west side of the mountain, between the rivers Blanche and Claire midway between sea and summit, which comprised vents giving temperatures of nearly 500 degrees C. in 1908 have likewise greatly diminished in activity, although vents were found which even now give a temperature of 128.5 degrees C. (265 degrees F.). On the whole however it is evident that the activity of the volcano has greatly and continually diminished since the outbursts of 1902–1903, and apparently there is no present danger of recrudescence.

On the east or windward side of the volcano, the vegetation has reëstablished itself to the summit of the mountain, and even the forest is beginning to reassert itself. The whole aspect of this side of the volcano is verdant and peaceful, and gives no indication of the devastation of thirteen years ago; even the rocks of the new cone are more or less thickly coated with moss, while the side and top of the old cone are covered with grass, ferns and bushes, in addition to moss and lichens. On the summit plateau we found an abundance of red raspberry bushes bearing flowers and green and ripe fruit.

Sugar plantations on the west side of Mt. Pelé have been reinstated as far as the Roxelane River, within the border of the original zone of annihilation, while the ruined city of St. Pierre now contains about thirty new buildings of durable construction and a resident population of possibly two hundred people.

The southwest side of the volcano lying between the Seche and Blanche rivers, which

[1] Dr. Edmund Otis Hovey, curator of geology and invertebrate palæontology in the American Museum, has returned from the first expedition undertaken with the assistance of the Heilprin Exploration Fund. This fund was established in 1914 by relatives of the noted explorer and geographer, the late Angelo Heilprin, for the purpose of aiding geographical work under the auspices of the American Museum. On account of Professor Heilprin's well-known work on the 1902–1903 eruptions of Mt. Pelé, Martinique, it was considered particularly appropriate that the first work under the fund should concern the active volcanoes of the Lesser Antilles in continuation of the work already done by the American Museum in 1902, 1903 and 1908. The object of the visit was to make a comparison of conditions past and present, in connection with assembling for publication all previous observations on the eruptions.

The first stop was made at Guadeloupe where sixteen days were spent, three of which were passed on the summit of the Soufrière. On Martinique eleven days were spent in camp on the old summit plateau of Mt. Pelé, while on St. Vincent more than three weeks were given to the study, twelve days of the time being spent in camp on the volcano. Many specimens were brought back to New York to illustrate the changes that have taken place in the rocks during the past seven years, and scores of photographs were taken to add to the extensive collections already in the possession of the Museum as a result of former expeditions.

was the route traversed by hundreds or perhaps thousands of destructive eruption clouds, still lies drear and desolate, because the soil was completely swept away by the blasts, and the material left behind as well as that added by the eruption is too porous for the retention of the water necessary to restore it to fertility. Furthermore, the rainfall of the west side of the island is much less than on the east side, and the region is dried by the rays of the afternoon sun.

The vicinity of the Soufrière on the island of St. Vincent also shows evidences of recovery from the previous activity. Here as in Martinique, the vegetation has reëstablished itself more thoroughly on the windward than on the leeward side of the mountain. Considerable portions of the Soufrière received immense deposits of gravelly ash from the recent eruptions, and these are largely barren at the present time. Other areas received a finely comminuted ash which retains water better than the coarse material, and suffers more rapid decomposition. This fine ash is now coated more or less thickly with moss and lichens, and often bears, in addition, bushes, trees and tree ferns. The outer limits of the original zone of annihilation show merely a destruction of the vegetation then coating the mountain slopes, and did not suffer destruction or deep burying of the soil.

Palms and tree ferns have regained their pristine development and beauty in this region, and forest trees are growing. On the east side of the mountain the sugar-cane plantations which flourished before the eruptions are now largely restored to cultivation and present a heavier growth of cane than before, while on the west side peasant proprietors are already taking up "provision ground" on the slopes of the volcano itself.

The great crater of the Soufrière is beautiful enough to repay the lover of scenery for making a special trip to the island. It is about nine-tenths of a mile across from east to west, and three-quarters of a mile from north to south, and a lake approximately half a mile in diameter now occupies its lower portions, as its predecessor did in the days before the eruptions which changed the whole appearance of the mountain. In 1902–3 there was a little pool of muddy water in the bottom of the bowl through which disturbing columns or puffs of steam were continually rising. In 1908 the pool was much larger, was yellowish green in color and was not disturbed by any eruptive discharges, but it did not fill the bottom of the crater. In 1915 the lake is apparently some hundreds of feet deeper than it was in 1908 and occupies the entire bottom of the crater, rising well up on the vertical walls in most places. Careful measurements with the theodolite established the surface of the lake as being 760 feet below the point where the trail from the western side of the island reaches the rim of the crater, or approximately 2140 feet above the level of the sea.

The interior walls of the crater are coated with moss and tufts of grass wherever there are slopes of volcanic ash, and tree ferns and bushes are reëstablishing themselves in the ravines cut by the rains, while the vertical faces of the old lava beds making up a large part of the mountain add tones of reddish and yellowish gray to the color effect.

The volcano on Guadeloupe, unlike those of Martinique and St. Vincent, shows no decrease of temperature over the past. The summit of the Soufrière gives opportunity for temperature observations on the fumaroles and the study of the escaping gases. These fumaroles have been active, with varying degrees of strength, during all the historic period of the volcano. A marked increase of discharge of sulphureted steam took place at the time of the eruptions of Martinique and St. Vincent, and an area several acres in extent was then added to the active region. The vents maintain to-day the force of their discharge, but the temperature does not in any case exceed 100 degrees C. (212 degrees F.). The eastern member of the twin islands forming Guadeloupe is sedimentary in origin, and presents geological facts of value in their bearing on the general history of the Antilles.

GROUND-SLOTH FROM A CAVE IN PATAGONIA

By W. D. Matthew

COLONEL ROOSEVELT has recently placed on deposit with the Museum three fossil specimens of remarkable interest. These are a fragment of the skin and hair, a piece of the bone and a mass of dung of an extinct ground-sloth from the cave at Last Hope Inlet in Patagonia, presented to him by Señor Moreno, director of the La Plata Museum, near Buenos Aires.

The great ground-sloths of South America are among the most remarkable and interesting of the giant quadrupeds which formerly inhabited that country. Many skeletons have been found, especially in the Pampean formation of Argentina, and a fine series of them is shown in the Quaternary mammal hall. They were supposed however to have been extinct for many thousands of years, and it was a disputed point whether or no they were contemporaries of primitive man in that continent. The exploration of this cave about fifteen years ago furnished abundant proof that one species at least of these strange animals survived to within a few centuries of the present day, and was not only contemporary with primitive man but was in some sense of the word domesticated by him. Numerous bones and pieces of skin were disinterred from a layer composed of dust and ground-sloth droppings beneath the floor in a dry protected corner of the cave, in company with tools or weapons of stone and bone and bearing unmistakable marks of being cut and fashioned artificially. Bundles of grass spread as though intended for fodder, and other indications showed that the animals had been stabled or imprisoned within the cave and fed by their captors. The dry floor protected against damp and weather has preserved skin and bones with bits of tendon and dried flesh clinging to them, and the hair is often in perfect condition. Making all reasonable allowance for these favorable conditions, one can hardly suppose that these remains are more than a few centuries old. There is reason to believe that they are not much less than that, and that they antedated the arrival of white settlers in this region.

The skin is covered with a thick coat of golden brown hair, of the same peculiar coarse brittle texture as that of the modern tree-sloth, the nearest living relative of the great ground-sloths. In the under side of the skin are imbedded numerous rounded nodules of bone studded thickly enough to make it a fairly effective defense against the attacks of carnivora. Quantities of similar nodules have been found associated with petrified skeletons of ground-sloths and it had been supposed but never before proved that they were imbedded in the skin during life.

The bone fragment has remnants of the dried flesh and tendons still adherent, and shows clearly the marks of the tools used in cutting it up. The mass of dried dung, utterly unlike that of any living animal of that region completes the illusion. It is difficult indeed to believe that these are relics of animals extinct for some hundreds of years. But the rumors that the *Grypotherium* still survives in the wilds of Patagonia, based probably on the extraordinary freshness of these remains, have been repeatedly investigated by subsequent explorers and found to be baseless.

Miss Dora Keen of Philadelphia, who visited the locality a few years ago, has also presented to the Museum a sample of hair of the ground-sloth taken from this cave.

THE SOMAIKOLI DANCE AT SICHUMOVI

By F. S. Dellenbaugh

ARTICLES in the March number of the JOURNAL on dances of American Indians recalled to me that I have seen several Indian dances in years past. In 1884 I spent some weeks on the East Mesa of what we then called the Moquis Villages, now the Hopi, at that time a somewhat remote region. There were no white men in that country except three or four at Keam's trading post, fourteen miles from the East

Mesa, until one reached Hubbell's Pueblo, Colorado, forty-six miles from Keam's, and then thirty-five miles farther east at Fort Defiance. To the south it was eighty miles to the new town of Holbrook on the just completed Atlantic and Pacific Railway, now the Atchison, Topeka and Santa Fé, and to the west and north there was no camp or settlement until the great cañon of the Colorado was crossed and then it was about one hundred miles to Kanab. The only other white man in the Hopi Province at the time I was there, was Dr. Jeremiah Sullivan, who lived in Sichumovi with the chief, Anawita, and had been to some extent initiated into that tribe.

I had rented from Tom Polacka, a Hano (Tewa) native, the top story of Tewa, a single large room with a fireplace in one corner, and with a porch in front of the door, formed by the roof of the house below, where I could smoke my pipe and easily imagine myself, as I looked along the entire mesa toward Walpi, much farther away from the toiling world than actually I was.

On Saturday, November 8, I recorded in my diary: To-day the Moquis have been making great preparations for to-morrow which is a great dance day. To-night they cleaned up the rubbish and threw it over the cliff. To-night is *Tō-tō-kĭ-ă*, *Tō-tō-kĭ-pĭ* or *Tōk-tĭght-ă*, the "night of dancing."

My diary for Sunday, November 9, further records: To-day was a great one on this mesa. About sunrise I heard the drum going at Sichumovi and a great yelling, and getting up I saw a crowd in the plaza, but the principal actors soon returned to their kiva. The dancing did not begin again until about eleven o'clock and then it did not stop until sunset — dancing with singing and hammering on the drum. The drummer, with his big drum, sat in the center of the plaza with six or seven singers, around whom was a circle of about forty men, boys, women and girls, all togged out in their best. "Mose" was there dressed all in black (cambric) and did not look half so well as in his ordinary clothes. It is strange what a fancy these Indians and the Navajo have for black. One man had on calico trousers, one leg one pattern, the other another.

The women wore white blankets with red borders and they had their hair done up in quite a different fashion from the ordinary. It was brought down smoothly and fastened behind in a sort of long knot wrapped with red yarn. Over the forehead from ear to ear was a kind of thick fringe of black hair about four inches long, sewed to a string and tied about the head in such a manner that the eyes were almost obscured. Their feet were moccasined, which they are not on ordinary occasions, and the buckskin of the top of the moccasin swathed their legs, as when they ride.

The members of the circle sang together as the circle slowly moved from left to right. Each man or boy chose a partner and joined the circle with her. It was absurd to see a tall Indian enter with a girl of only seven or eight years. [I learned later that the older girls were not permitted to take part].

Presently there was a shouting in the direction of the kiva, "Yah-hai — yah-hai," very loud, and looking that way I perceived a man coming, nude excepting for a kilt, and painted yellow. On his head were feathers. His hair was "banged" in front above the eyes, cut short on the sides, and hung down long behind. From his waist at the back trailed a foxskin. In his right hand he carried a gourd rattle painted green and white and filled with small pebbles, judging from the sound. In the left hand he carried a sort of baton with a cloud symbol in the middle and a free swinging pendant at either end. Immediately behind him was one of the most grotesque figures I have ever seen. It was one of those innumerable Hopi ghosts, saints or minor gods known as a "katcina," covered with all sorts of trappings, and heavy wrapings about the head with the semblance of a mask in front (the mask fantastically decorated with green and other colors), a strong bow in his right hand which he used as a staff (the quiver being hung to his left side), and in his left hand an ear of corn and a small bent stick. He came prancing and dancing and jumping after his leader in the most extraordinary way. The deer hoofs hung around his waist rattled loudly. He was supposed to be blind. His leader rattled as hard as he could rattle and advanced a few steps toward the group shouting an incantation, then suddenly turned and faced the katcina and yelled "Yah-hai — yah-hai" at the top of his lungs. Then he walked on shouting, the drummer thumped away on the drum, the singers and dancers sang, and the katcina capered about in frantic spasms of tramps and jumps, never stopping for an

instant. They neared the circle, which broke on one side, and as it became a semi-circle, the dance ceased. The leader and katcina then circled around the drum. The leader shouted in the ear of the katcina at frequent intervals his "Yah-hai — yah-hai" and yelled his incantation, waving the balance-looking arrangement. This, by the way, is the charm that attracts the katcina and yet holds him off [Sullivan]. After several rounds of this yelling, singing, shouting and jumping, the leader returned to the kiva, slowly followed by the skipping katcina. The circle continued the dance, closing its ranks, and so on until another leader and katcina made their appearance. Sometimes there were three or four at the same time and then the noise was deafening.

All day long this continued, and all day I stood my ground with camera and sketch book, notwithstanding certain disapproving looks from the dancers. At one time I thought they meant to tell me to stop using the camera but they did not do so; probably as they had never seen a hand camera before, they did not understand its nature. With the plates manufactured then, and the slow shutter, it was very difficult to get the swiftly darting figures; and that day I was as much of an object of interest to the visiting Navajo, and the Hopi from the other towns, as were the katcinas and the dancers. Nobody molested me however and at sunset when the long procession of katcinas and leaders had passed through the village and received the contributions of sacred meal and prayer feathers from the populace, all weird enough in the gloaming, I returned to my housetop and slept without a break until Hoski, my native boy, after his usual fashion, threw the door open in the morning and set down the olla of water which he always brought up fresh from the spring near the foot of the mesa, some seven hundred feet below.

MUSEUM NOTES

A JOINT anthropological expedition will be undertaken with the University of Colorado of which the distinguished anthropologist, Dr. Livingston Farrand, is now president. The field party will be under the direction of Mr. N. C. Nelson, assistant curator of anthropology in this Museum, and Mr. E. H. Morris, curator of the University Museum, and will explore the little-known cliff-dwelling regions of Colorado.

THE New York Academy of Sciences has published an essay on "Climate and Evolution" by Dr. W. D. Matthew. This is an attempt to find in the slow cyclic climatic changes of geologic time a fundamental cause controlling the course of evolution and geographical dispersal of animals and plants. The author accepts the view that the deep ocean basins have been substantially permanent during the later ages of geologic time, the continents alternately emerged and more or less completely united to the northward, or submerged and extensively overflowed and isolated by shallow seas. The continental shelf at or near the one hundred fathom line marks the extreme limit of emergence. The epochs of elevation have been associated with arid climates and polar cold; the epochs of submergence with warm moist uniform climates. The record of the evolution and dispersal of the various races of mammals is interpreted in accord with this theory, that of the lower vertebrates briefly outlined.

THE New York Aquarium gave its second annual reception to the members of the New York Zoölogical Society on the evening of May fifth. About five hundred guests were present and were entertained with motion pictures of marine life. The Aquarium had just come into possession of a new collection of tropical fishes from Key West, which were on exhibition, and two more porpoises had been secured for the porpoise pool.

SOME years ago Mr. G. Frederick Norton began a special study of the so-called blue or "glacier" bear (which had been named *Ursus emmonsi*). These bears are confined to the vicinity of Saint Elias range of mountains in Alaska and have a very limited distribution. Mr. Norton secured a number of skins and skulls which have satisfactorily demonstrated that the blue bear is only a color phase of the black bear (*Ursus americanus*). The black bear apparently is a polychromatic animal and has several well-marked color

phases which in some instances are very local. A few years ago the Museum secured two beautiful skins and skulls of the white bear from Gribbell Island, British Columbia, (which had been named *Ursus kermodei*), through Mr. Kermode, curator of the Provincial Museum, Victoria, British Columbia. There seems to be little doubt that instead of being a new species, the white bear is also a color phase of the black bear. The so-called cinnamon bear is a well-known color phase of this same species. Very often in a single litter black and cinnamon bears are found together. The Museum has in mind the preparation of a group showing all of these color phases of the black bear. Through a gift to the Museum by Mr. Norton of a magnificent specimen of a glacier bear taken in Disenchantment Bay, Yakutat, Alaska, there remains only the lack of a cinnamon bear to allow the construction of such a group.

THE department of invertebrate zoölogy will actively participate in the Porto Rico Survey during the coming summer. Dr. F. E. Lutz and Mr. A. J. Mutchler will prosecute entomological investigations in various parts of the island; Mr. Roy W. Miner and Mr. H. Mueller will establish headquarters at Guanica Harbor for studies upon marine invertebrates; while Professor Raymond C. Osburn will carry on dredging operations mainly along the southwest shores, coöperating with Mr. Miner. For several weeks Dr. A. G. Mayer of the Carnegie Institution and a group of zoölogists will also be carrying on special investigations about Guanica.

SINCE the last issue of the JOURNAL the following persons have become members of the Museum:

Patron, MRS. BASHFORD DEAN;

Fellow, MR. HENRY FORD;

Life Members, DR. EMILIE SNETHLAGE, and MESSRS. FREDERIC ALMY CAMMANN, JAMES P. CHAPIN, ANDRE DE COPPET, FRANK LEGRAND GILLISS, HERBERT LANG, P. W. LIVERMORE, HERMAN STUTZER and JAMES B. WILBUR;

Annual Members, MRS. GEORGE CONRAD COOK, MRS. RACHEL LENOX PORTER, MISS ALICE L. CLARK, MISS ELIZABETH DOUGLAS, DR. P. MAXWELL FOSHAY, DR. HARRY JUSTIN RODDY, DR. CHARLES H. YOUNG, and MESSRS. I. DE BRUÏN, GEORGE H. CLAPP, HERBERT STANLEY CONNELL, HENRY DOSCHER, FREDERIC HUNTINGTON DOUGLAS, HOLLAND S. DUELL, JOHN M. GLENN, F. HERRMANN, AUGUST KUHN, JULIUS KUHN, LEE LAURIE, IVY L. LEE, E. A. MCILHENNY, WILLIAM C. MURPHY, D. E. POMEROY, ROGER M. POOR, ROBERT W. SAYLES, H. JERMAIN SLOCUM, JR., FRANK B. SMIDT, JACOB STEINHARDT, CARLL TUCKER, WILLIAM YOUNG WESTERVELT and FREDERICK N. WILLSON.

MR. HERBERT LANG has been appointed assistant in mammalogy and Mr. James P. Chapin assistant in ornithology. Mr. Lang and Mr. Chapin have also been elected life members of the Museum in recognition of their efficient services in conducting the Congo expedition.

MRS. BASHFORD DEAN has recently been elected patron of the Museum in acknowledgment of her recent contributions toward the preparation of the bibliography of fishes; Mr. Henry Ford has been made fellow, in appreciation of his generosity in presenting to the institution the bust of John Burroughs; and Dr. Emilie Snethlage, life member, in recognition of her practical interest in the development of the Museum's South American collections.

DR. CHESTER A. REEDS and Mr. Prentice B. Hill of the department of geology and invertebrate palæontology will leave on May 29 to carry on stratigraphic and palæontologic investigations in Porto Rico in connection with the Porto Rico Survey.

MESSRS. H. E. ANTHONY and D. S. BALL have returned from an expedition to the mountains of the Isthmus of Darien in eastern Panama, bringing with them a collection of 1100 birds and 250 mammals, many of which are new to the Museum's collections and some undoubtedly new to science. These collectors left for the field the latter part of January, but owing to the inaccessibility of the country to be explored, they had only about two months in which to accomplish their work before the rainy season set in. It took them nearly a month to reach the ground where they were to do their collecting and almost as long to return from there. At the City of Panama they were joined by Mr. W. B. Richardson, who had been doing some preliminary work in Darien. The party left the City of Panama on February 8 and going

down the coast in a gasolene launch to El Real, began to ascend the Tuyra River, a river several miles across at the mouth. In the lower part of the river they were obliged to leave the launch and take to canoes, traveling in this way as far as the foothills of the mountain. There they got natives for packers and carried their outfit for three days' journey to the foot of Mount Tacarcuna, from which point most of the work was done. Later camp was made at the very highest point on the mountain where there was any water. From this site on the mountain range that forms the boundary between Panama and Colombia, the Atlantic could be seen in the distance. The region, probably because of its inaccessibility, has never before been explored biologically. Indeed the Indians there had never seen a Northern white man before. Its fauna presents an important scientific problem because it seems to indicate that the mountain range which forms the Isthmus of Darien was at one time connected with the western Andes of northern Colombia.

In 1913 Dr. William T. Hornaday, advocate of wild life protection, decided that the cause could not be adequately supported through annual subscriptions. He determined upon the creation of what is now known as the "Permanent Wild Life Protection Fund," for nation-wide campaign work during the next one hundred years, the "income only for use on the firing-line." The wild life protective principles are formulated as follows: Stop the sale of wild game; promote laws to prevent unnaturalized aliens from owning or using rifles and shot-guns; stop all spring and late-winter shooting; stop all killing of insectivorous birds for food, and of all birds for millinery purposes; increase the number of game preserves; oppose the use of all extra deadly automatic, auto-loading and "pump" guns in hunting, and secure the passage of laws against them; secure perpetual close seasons for all species of wild life that are threatened with extinction from our fauna.

The plan has already received a remarkable series of indorsements. The minimum fixed upon was $100,000, and up to date $73,050 has been subscribed. This is the second largest endowment fund in existence for the benefit of wild life. The Banking Trustees of the Fund are Messrs. Clark Williams and A. Barton Hepburn. Dr. Hornaday, as the ampaigning trustee, expends the annual income of the Fund in accordance with the principles originally formulated. A rather novel feature of the plan provides that the names of all persons who make large sacrifices for the formation of the Fund shall be known as Founders, and that their names shall be permanently associated with the Fund and its results. The most important work to be undertaken in the immediate future under the auspices of this Fund, is the promotion of a very comprehensive plan for the creation of game sanctuaries in national forests. This campaign will begin on September first and will be prosecuted with much vigor until complete success is achieved.

Through interest created by the Roosevelt South American expedition, the Museum has received six hundred birds and fifty mammals, presented by the Goeldi Museum of Pará, through its director of zoölogy, Dr. Emilie Snethlage. The members of the North American expedition when passing through Pará in May, 1914, called on Dr. Snethlage to examine the rich collections of Amazonian fauna which she, and her predecessor Doctor Goeldi, have amassed. Dr. Snethlage writes that shortly after the Roosevelt party passed through Pará she herself embarked on an expedition into the unexplored portions of the Upper Xingú, on which she was absent seven months. Unfortunately, within a month after her departure from Pará, the middle finger of her right hand was bitten off to the base by a piranha, the small man-eating fish of South America.

An exhibit to illustrate the principles of Mendelian heredity has recently been installed in the Darwin hall and is temporarily labeled. As at present exhibited, there are five panels showing as many instances of inheritance in plants and animals: first the classical case of the seed color of the common pea, based on Mendel's original experiments; second, complex inheritance as illustrated by the colors of the sweet pea, based on the experiments of Bateson; and third, three panels to illustrate the inheritance of coat color in the common rat, namely, the effect on the third generation of crossing one, two and three varieties of unit characters respectively. A more detailed account of this exhibit will be given in a future issue of the Journal.

THE exhibit in the Darwin hall showing variation under domestication has been rearranged and forms one of the items in a series illustrating Darwinian principles. In this case the chief variations of the dog, the pigeon and the common barnyard fowl are shown.

Mr. N. C. NELSON of the department of anthropology is engaged in excavating the prehistoric and early historic ruined villages in the neighborhood of Santa Fé.

"THE Evolution of the Jaw Muscles of Vertebrates" was the subject of a recent presentation before the New York Academy of Sciences by Prof. L. A. Adams, who has been investigating this subject in the Museum laboratory of vertebrate evolution. By means of the stereopticon he exhibited a series of very clear drawings of the skull and jaw muscles of a score or more of representative vertebrates of all classes, and showed by what comparatively slight successive changes the arrangement of the jaw muscles of primitive fishes has given rise to the various modifications that are characteristic of the higher types.

THE civic exhibition at the National Arts Club is one of the most instructive yet brought together on the problems touching artistic betterment of New York City. Maps, photographs, architectural designs and sculptural models bring out many proposed plans for beautifying Riverside Drive and its docks, besides various bridges, streets and parks. Among suggested features for decoration of buildings may be noted mural designs by E. W. Deming and Will S. Taylor and sculptural animal designs by Carl E. Akeley, all of the American Museum's staff and at present engaged in work for the artistic improvement of the Museum buildings.

SUBSTANTIAL progress has been made in installing the new storage system for dinosaurs and other fossil reptiles. Most of these large and heavy specimens have hitherto been laid out on mats on wooden tables ranked three deep, filling up the large dinosaur storeroom at the top of the southwest tower wing; the remainder stored in wooden trays piled up in every available corner of the storerooms and laboratories. The arrangement was originally intended as a temporary one, but for lack of a better equipment has lasted fifteen years. It was somewhat cumbersome, the larger fossils were exposed to dust and risk of breakage, the smaller ones difficult of access, and the danger of serious fire damage became continually greater as constant additions crowded the collections more and more.

The new system will provide ultimately three double stacks of steel racks twelve feet high with strong but light steel framed trays three by four feet, and wall racks for the smaller wooden trays. The specimens are laid out on mats in the large trays and lifted up by a small movable elevator. The system is adjustable and compact, and enables the large heavy and often fragile bones to be moved with safety and convenience. The great saving in space is shown by the fact that the one double stack now installed accommodates most of the contents of the storeroom, so full under the old system as to be unmanageably crowded. Other collections which for lack of room were temporarily placed elsewhere will find ample storage space and security in the second stack now under construction and in the wall racks. The third stack is planned for accommodation of future collections but will not be installed at present.

The trays will be protected from dust by fireproofed covers and curtains. The risk of fire is now slight as there is practically nothing to burn except the old wooden trays which must be retained for the present to contain the smaller specimens, and the adequate space around these will make it easy to control any fire that might get started. The room now available to lay out dinosaur skeletons for study and comparison has been urgently needed for research work on these collections. The lighting of the storeroom has also been greatly improved.

THE Southwestern Anthropological Society for promotion of research work in the history and ethnology of the Southwest has recently been organized at Santa Fé. Dr. Livingston Farrand, president of the University of Colorado and formerly curator in the American Museum, was elected president and Dr. Paul Radin, secretary. Dr. P. E. Goddard and Mr. N. C. Nelson of this Museum have been invited to become members of the committee on research.

MR. CHARLES W. MEAD, assistant curator of anthropology, in charge of the South

American collections, has just completed an exhaustive investigation of the native copper and bronze industry of the New World. The primary part of the investigation was the chemical analysis of one hundred and sixty museum specimens, so selected as to give typical series for each important locality. The laboratory tests were made by Mr. W. A. Wissler, A. M. Mr. Mead finds by correlating the chemical determinations with the distribution and types of implements, that the prehistoric Peruvians thoroughly understood the art of making bronze from copper and tin. In addition, he has brought together the early fragmentary accounts of Spanish explorers as to how these metals were worked, which became more intelligible in the light of the chemical studies. Among the obscure and little-known sources is the *Arte De Los Metales* by Alvaro Alonso Barba, published early in the seventeenth century, a copy of which was kindly placed at Mr. Mead's disposal by Mr. E. P. Mathewson of the Anaconda Copper Mining Company. The full report of this study will soon appear in the *Anthropological Papers* of the Museum.

Dr. Robert H. Lowie and Mr. Alanson Skinner of the department of anthropology have just completed five publication reports upon their last year's field work among our western Indians. Dr. Lowie made a special study of the societies and social organizations of the Ute and Shoshone, while Mr. Skinner investigated the same aspects of primitive culture among the Iowa, Kansa and Ponca tribes. These reports will appear in a special volume of the *Anthropological Papers* now nearing completion, treating the societies and social organizations of the Plains Indians in an exhaustive manner.

On April 9, Dr. W. H. R. Rivers of Cambridge University, England, visited the department of anthropology of the Museum, having stopped a day in New York on his return from attendance at the Australian meeting of the British Association for the Advancement of Science and a subsequent visit to several of the South Sea Islands. Dr. Rivers is known among anthropologists throughout the world for his intensive researches into the ethnology of the Torres Straits Islanders and of the Todas of southern India. More recently he investigated various of the Melanesian groups as director of the Percy Sladen Trust Expedition. He has profoundly stimulated ethnological thought by developing the genealogical method as a means of research in the study of social usages and by directing attention to the importance of kinship nomenclature. His latest publications, *Kinship and Social Organisation* and *The History of Melanesian Society* are largely devoted to the latter topic and form a landmark in the history of the subject. At the Museum, Dr. Rivers examined with interest the collections in the South Sea hall and discussed the investigations of kinship terminologies of North American and Oceanian peoples.

Mr. Russell J. Coles has presented to the Museum an eighteen-foot female *Manta* (devilfish or giant ray). This was caught on April 11 in the Gulf of Mexico, some one hundred miles south of Tampa, after a dangerous twenty-two-minute fight with the giant fish. Mr. Coles was instrumental last year in procuring for the Museum two specimens of *Manta*, respectively eleven and seven and one-half feet across, but knowing that the species reached a much larger size, he has not rested until a finer specimen was secured. The one just captured is, as far as we are aware, the largest recorded on our Atlantic coast, for while the species is popularly said in books to reach a width of twenty feet, none of these giants has as yet come to hand. A reproduction of this eighteen-foot animal will make a magnificent addition to our exhibit of fishes.

In the New York City building at the Panama-Pacific Exposition, to the right of the entrance, is an alcove containing photographic exhibits of the several museums and libraries of New York City. The selected exhibits from the American Museum of Natural History aims to indicate to the general public the institution's scientific scope, its financial status, and its place in the city as an educational institution.

Dr. Robert H. Lowie will leave early in June for field work among the Kiowa Indians of Oklahoma, the Hopi of Arizona and the Paiute of Nevada. From the Kiowa Dr. Lowie hopes to secure information concerning their military societies; the investigations among the Hopi will cover social organization or clan system; and the work in Nevada is a continuation of that undertaken last year as part of the Museum's extensive survey of Shoshonean tribes.

THE American Ethnological Society, which was founded in 1842 by Mr. Albert Gallatin, has adopted a new constitution with a view to incorporating a society for the safeguarding of its growing endowment fund.

THE Museum has recently secured a large collection consisting chiefly of pottery taken from the island of Marajo, Brazil, by Mr. Algot Lange. This pottery was secured on Mr. Lange's second expedition to South America, the first having been made for the University Museum of Philadelphia.

A REPRESENTATIVE collection of Salvador archæology which Dr. Herbert J. Spinden obtained last summer by arrangement with the government of Salvador, has lately arrived at the Museum and has been installed in the Mexican hall. The specimens include pottery and stone, and represent a long period of art with several distinct phases. There are many examples of archaic pottery which may date from before the time of Christ, as well as beautiful painted vases of the Maya civilization and glazed ware of the Aztec period.

PROFESSOR C.-E. A. WINSLOW has been appointed to the newly established Anna M. L. Lauder professorship of public health at the Yale Medical School. He will give up his connection with the New York State Department of Health and the Teachers' College to take up this work next fall, but will continue to act as curator of public health at the American Museum.

AT the May meeting of the New York Academy of Sciences Dr. Charles H. Townsend exhibited moving pictures of recent Biological Survey dredging operations in Long Island Sound by the United States Fisheries steamer "Fish Hawk." The fauna of the muddy bottom in the middle of the Sound, Dr. Townsend said, is considerably different from that along the margins where oyster beds abound. It includes great numbers of spider crabs, flounders and whelks. Dr. Charles B. Davenport, director of the Carnegie Station for Experimental Evolution at Cold Spring Harbor, described the fauna of the brackish waters on the north shores of Long Island and showed how different forms which are dependent upon salt water, such as mussels, Littorea and barnacles, manage to live in brackish water if they can get purer salt water at high tide. Professor Raymond C. Osburn read a paper on the "Geographical Distribution of the Bryozoa of the Atlantic Coast of North America." Nearly three hundred species of Bryozoa are known to inhabit the coastal shelf down to the hundred-fathom line. The species fall for the most part into three groups: (1) cosmopolitan species or those of wide range; (2) northern species often circumpolar, which range southward along the coast; (3) tropical species, which range northward from Florida. Charts indicating the relation of the bryozoan distribution to ocean temperatures and currents were exhibited.

DR. RAYMOND C. OSBURN of the New York Aquarium, assistant professor of zoölogy in Barnard College, Columbia University, has accepted the professorship of biology in the Connecticut College for Women at New London. He will be greatly missed by his colleagues in New York, who hope that he will be able to keep in touch with his scientific interests here.

NOTICE of the death of the distinguished English palæontologist and zoölogist, Richard Lydekker occurs in *Nature* for April 29. Dr. Lydekker was well known as a high authority upon mammals both living and extinct. His most notable contributions to scientific research dealt with the fossil mammals and dinosaurs of India and Argentina, but he is perhaps better known as the author of a number of excellent text-books and treatises of a more popular kind dealing with the living and extinct mammalia. Among these may be especially mentioned: *A Geographic History of Mammals*, *Mammals Living and Extinct* (Flower and Lydekker), *Manual of Palæontology* (Nicholson and Lydekker), *The New Natural History*, *Deer of All Lands*, *The Horse and its Relatives*, *The Ox and its Kindred*, *Game Animals of Africa*, *Game Animals of India*, *Mostly Mammals* (a collection of essays). He was the author of the Catalogues of Fossil Mammals, Reptiles, Amphibians and Birds in the British Museum, of numerous articles in the last edition of the *Encyclopedia Britannica*, a frequent contributor to *Nature*, *The Field*, *Knowledge*, *Science Progress* and other English periodicals, to the *Proceedings of the Zoölogical Society* and other journals of research.

MR. HOWARD MCCORMICK has begun work on the canvas for the background of a second Indian habitat group to be placed in the Southwest Indian hall. The group represents Apache Indians engaged in various occupations under a flat-topped shelter of boughs and gives as a background a view of the San Carlos river valley and neighboring mountains where these Apache live. Studies for the group were made by Mr. McCormick in Arizona in 1914.

THE Museum has recently secured by purchase through the Dodge fund, from Mr. P. A. Bungart, a local collector of Lorain, Ohio, a valuable collection of Dinichthyids from the Devonian shales of Ohio. The collection of thirty-three specimens includes several complete crania and a number of other remains of high scientific value.

MR. F. A. WATSON is on the north coast of Santo Domingo making collections for the department of invertebrate zoölogy. The expenses of his trip are being covered by Mr. B. Preston Clark of Boston, Massachusetts. Mr. Clarence R. Halter, who is spending May and June in the same region, is collecting reptiles and batrachians for the Museum.

THE sledge used by Admiral Peary on the expedition which reached the North Pole, has been loaned to the Oakland Museum for exhibition during the period of the Panama-Pacific exposition.

THE purchase of the collections made by Mr. Richard Douglas in Matebeleland, South Africa, a few years ago, secures to the Museum a large series of prehistoric stone implements and a considerable series of baskets and other ethnological specimens, as well as small collections of reptiles, mammals and birds from the region.

Two accessions of interest recently received by the department of anthropology are an Indian-made canoe, weighing thirty-nine pounds and decorated with beads on the bow, the gift of the Hudson Bay Importing Company, and a beautiful feather hammock from Brazil presented by Mr. Charles R. Flint.

A PRELIMINARY report on the fishes obtained in Porto Rico last summer by Mr. John T. Nichols is published in the *American Museum Bulletin*. Mr. Nichols lists twenty-two species not previously recorded from the island and describes two new species. His work on the fishes of Porto Rico was done in connection with the biological survey of the island made by the New York Academy of Sciences for the insular government.

AMONG the recent anthropological publications of the Museum is one on Pawnee Indian Societies by James R. Murie, a distinguished Pawnee chief. For several years Mr. Murie has been gathering data from the oldest men of his race and under the immediate supervision of Dr. Clark Wissler, has prepared several manuscripts for publication, of which the present issue is the first.

PROFESSOR A. L. KROEBER, head of the department of anthropology in the University of California, will spend the next academic year in New York City as a guest of the Museum. He has also volunteered to assist in the Museum field work by spending the summer in the Pueblo of Zuñi. Professor Kroeber was formerly connected with this Museum, when he distinguished himself in the investigation of American decorative art.

DR. FRANK E. LUTZ, of the Museum's department of invertebrate zoölogy, has been appointed a member of the board of editors of the *New York State List of Insects*. Mr. Charles W. Leng, honorary curator of Coleoptera of the Museum, is also a member.

GENERAL THOMAS H. HUBBARD, lawyer, veteran of the Civil War and director in many corporations, died at his home in New York City on May 19 after an illness of but a few days. General Hubbard had been a member of the American Museum of Natural History since 1875 and had been somewhat closely associated with it through his interest in Arctic explorations. He was an active member of the Peary Arctic Club from the date of its first meeting in 1899 and was its president after the death of Mr. Morris K. Jesup in 1908. It was his financial aid together with that of Mr. Jesup, Mr. Crocker and other members of the Club, which made possible the discovery of the North Pole by Peary. Several Arctic geographical names, such as Hubbard Glacier and Cape Thomas Hubbard, bear witness to Peary's acknowledgment of General Hubbard's aid. General Hubbard was also one of the most generous contributors to the Crocker Land expedition.

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Price, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 cents.*

THE BIRDS OF THE VICINITY OF NEW YORK CITY. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

PERUVIAN MUMMIES. By Charles W. Mead. *Price, 10 cents.*

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY. By Edmund Otis Hovey, Ph.D. *Price, 10 cents.*

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS. By Frank M. Chapman, Sc.D. *Price, 15 cents.*

THE INDIANS OF MANHATTAN ISLAND AND VICINITY. By Alanson Skinner. *In preparation.*

THE STOKES PAINTINGS REPRESENTING GREENLAND ESKIMO. *Price, 5 cents.*

BRIEF HISTORY OF ANTARCTIC EXPLORATION. *Price, 10 cents.*

TREES AND FORESTRY. By Mary Cynthia Dickerson, B.S. *A new edition in course of preparation.*

THE PROTECTION OF RIVER AND HARBOR WATERS FROM MUNICIPAL WASTES. By Charles-Edward Amory Winslow, M.S. *Price, 10 cents.*

PLANT FORMS IN WAX. By E. C. B. Fassett. *Price, 10 cents.*

THE EVOLUTION OF THE HORSE. By W. D. Matthew, Ph.D. *Price, 20 cents.*

REPRINTS

THE GROUND SLOTH GROUP. By W. D. Matthew, Ph.D. *Price, 5 cents.*

METHODS AND RESULTS IN HERPETOLOGY. By Mary Cynthia Dickerson, B.S. *Price, 5 cents.*

THE WHARF PILE GROUP. By Roy W. Miner, A.B. *Price, 5 cents.*

THE SEA WORM GROUP. By Roy W. Miner, A.B. *Price, 10 cents.*

THE ANCESTRY OF THE EDENTATES. By W. D. Matthew, Ph.D. *Price, 5 cents.*

Protected entrance to the Altamira cave, near Santillana, northern Spain. Long ago the thinner part of the cavern roof fell in, creating a sink-hole from which one could walk in under the roof that still held. Here, near the entrance, Solutréan and Magdalenian men made their homes for a time and in a side gallery left a most remarkably preserved collection of paintings, the admiration of both the artist and naturalist who sees them. Later the wall entrance was sealed up by débris and was accidentally discovered in modern times by a fox hunter.